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ABSTRACT

This state of the art review gives an overview of the history of the development of Super 8 film, and describes a range of hardware associated with it, covering such areas as camera, sound synchronization, double system recording, lighting, film processing, sound transfer, editing, sound mixing, display, and methods of distribution. It examines the potential use of 8 millimeter for television broadcast, and examines Super 8 in relation to other media such as 16 millimeter film and videotape. It concludes that Super 8 is basically a production medium that is economical, versatile, and easy to operate. It is likely that it will have its greatest impact in the Third World. (WBC)

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Super 8: the modest medium

by Jonathan F. Gunter

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Preface

This publication is the first in an occasional series of monographs to be commissioned by Unesco on practical aspects of communication technology. Their purpose is to synthesize and share technical information as soon as it has reached a reliable stage of experimentation. Obviously, it is difficult to forecast in advance the trends and titles for such a rapidly changing field, but the monograph series will seek to treat from time to time those topics considered most urgent, most viable and most relevant to the needs of the developing world.

The first in the series focuses on recent developments in the field of 8-mm film, especially the rapid and continuing transformation of super 8 from what was originally an amateur medium into a growing professional tool with potential for adaptation to television. The review of developments in 8-mm film should provide a handy reference for audio-visual production centres, for film and television schools seeking economical training equipment, for television organizations desirous of augmenting their programmes with less-costly inputs, and for communication

planners preparing to make decisions on projects that might utilize film.

The basis for this monograph is a number of researches leading to a doctoral thesis on the use of 8 mm in developing countries. The author, Jonathan F. Gunter, holds a Doctor of Education degree from the University of Massachusetts. Author of several journal articles on non-formal education and educational media, he has served as consultant to communication projects in Ecuador and Colombia. At present he is Director of the Information Center on Instructional Technology at the Academy for Educational Development, Washington, D.C.

Other titles soon to follow in the monograph series will deal with low cost film animation, portable videotape production, and audiocassettes.

The opinions expressed in this study are those of the author and do not necessarily reflect those of Unesco.

Acknowledgements

Thanks are in order to several individuals who provided advice and information for this study. Mark Mikolas and Gunther Hoos of the Super-8 Film Group served as technical consultants, and were of invaluable assistance. Bob Doyle and Julie Mamolen of Super-8 Sound were also most helpful. I also thank Rick Minicucci of Super-8 Research Associates and many other manufacturers who obliged my requests for information and illustrations.

Information was gathered from sources in several countries, and treated according to its importance in the development of 8-mm film technology. Nevertheless, there may be omissions regarding equipment from some countries. There are two reasons why this may be the case.

First, it was not possible to travel internationally in connexion with this study. Obtaining information by mail often proved difficult. Secondly, 8-mm technology is advancing so rapidly that it is extremely difficult to stay abreast of developments.

For example, since the study was undertaken, two pieces of equipment have appeared on the

market which have transformed 8 mm in terms of its applicability in the world's non-industrial countries. The Kodak videoplayer makes it inexpensive and easy to broadcast 8-mm film by television. The Uhler Mini-printer makes it possible for an 8-mm production group to produce copies of its own films without depending upon any foreign technical service laboratories.

These advances in film distribution complement the professionalization of 8-mm production which has taken place over the last two years. They bring us to a plateau where it seems proper to assess the current state of the art, and to suggest applications for a technology which has developed with staggering speed.

Prices are only indicative and subject to variation because of tariffs or technical improvements.

Jonathan F. GUNTER

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Introduction

The emerging communication technologies which have attracted the most attention have been the large-scale, expensive and glamorous media. Much has been written about the promise of computers, communication satellites, and colour television. Yet, for all the enthusiasm that has been generated, results from these media have often been disappointing. Industrial countries have found that the large institutions created by such technology tend to lose sight of grass-roots clients' needs and to operate in their own narrow institutional interest.

In non-industrial countries, problems with complex large-scale communication technology are even greater. Dependence upon imported technical experts and foreign maintenance and repair facilities has been a source of frustration to many a Third World policy-maker. In educational settings, technology has often been attacked for eliminating rather than creating much-needed jobs.

In the shadow of the more glamorous technology, impressive advances have taken place in the realm of what can be termed 'modest media'. Several new

media options offer many of the same communication capabilities of complex technology, but without necessitating centralized large-scale organization, without dominating their educational or communication environment, without creating dependence upon foreign technical expertise, and without necessarily eliminating jobs. These 'modest media' deserve the attention of communication and education planners in both industrial and non-industrial countries.

All media consist of *hardware*[1] (equipment) and *software* (the messages or programmes produced and disseminated by the hardware). There is always interaction between these basic components in any communication technology. The characteristics of the hardware influence the types of software which can be produced and both influence the programmes. When 'modest' hardware/software develop, new types of media programming become possible, although it takes time for educators and communicators to take advantage of a changed situation.

The most obvious illustration of this process is the 'transistor revolution' in radio in the 1950s, whereas radio had previously been confined to electrified areas of the globe, radio reception spread to virtually the entire world. Less than ten years after the development of the transistor receiver, the audio-cassette recorder was developed. This device allows for inexpensive and simple production of audio materials. Fifteen years after the development of the cassette recorder, educators and communicators are now beginning to apply the tool to decentralizing and deprofessionalizing radio production.[2]

There are basic differences between radio's 'transistor revolution' and the '8-mm revolution' in film. Whereas the former began with inexpensive

1. All technical terms will be italicized when they are introduced. Readers can refer back to the first mention of a technical term by consulting the index on page 93.

2. For an initial indication of the implications of the new audio hardware, see the technical note on the Tabacundo Community Radio Project (Nonformal Education Center, University of Massachusetts, Amherst MA 01002 (United States)).

reception, the latter began with changes in production. 8-mm film has also expanded film distribution via film print, videotape and television. However, reception of film materials has yet to achieve break-through. The world is still awaiting cheap battery-powered television sets and film projectors. As a result, film will reach far less of the world's people than radio for the foreseeable future.

None the less, when film does reach people, it does so with a particularly powerful and vivid form of communication. To the audio communication capabilities of radio, film adds an elaborate visual language encompassing motion, colour and dynamic distortions of time and space. These communicative powers can now be exploited by a wider range of communicators and educators than ever before.

In the last ten years, new 8-mm film formats have developed from amateur media into tools which can be considered for professional communication tasks. The purpose of this study is to introduce the new hardware and to assess its current and future utility to communicators and educators. Readers are encouraged to develop a critical and reasoned appraisal of how these new tools can be of assistance to them.

At this point, a word of caution is in order. Whenever attention is focused upon a specific communication tool, there is a risk of placing the proverbial cart before the horse. Unless one's natural enthusiasm for a new tool is restrained, one is likely to take the new-found solution in hand and go out in search of a problem.

The work of the communicator and the educator must always centre upon problems before solutions, upon questions before answers. 8-mm film should be seen as only one of a number of communication tools which can be applied to human problems. The decision to use 8-mm should come only after an impartial planning process involving analysis of the specific problem and audience at hand.

After an audience and a problem area have been identified, a series of questions must be answered concerning the nature of the target audience, its

perceived needs, its communication habits and its resources. Next, specific problems and their communication components are identified. At this stage, a range of communication media and media mixes should be considered for their cost and effectiveness in contributing to solutions to the problems. 8-mm film should be applied to a situation only if 8 mm emerges from such a planning process as an effective component in the preferred solution. A decision in favour of 8 mm without such a planning process is a poor decision.

When attention is focused upon a new communication tool, the initial orientation should be not 'how-to-do-it' but 'what-can-be-done'. Only after considering the range of capabilities of new technologies should one become concerned with how to operate the technologies. This survey of current 8-mm film hardware will limit itself to 'what-can-be-done', with a few suggestions on where to go in order to learn how to do it. Special references will be made to the needs of communicators and educators of the world's non-industrial countries, who confront entirely different problems with entirely different resources than do their colleagues in industrial countries.

In industrial settings, technical skills are available, but highly priced relative to the cost of equipment. As a result, there is an economic incentive towards the use of ever more machinery, in order to reduce labour costs. Fewer but more highly trained people are employed.

In the non-industrial settings, the situation is quite different. Human labour is much less expensive relative to the cost of machines. Repair of machines is a greater problem. The training of manpower to operate machines is also more difficult. In this situation, one would hope for machinery that is inexpensive and easy to operate and maintain. One would hope to employ relatively more labour than machinery, and to create large numbers of jobs which do not require elaborate technical training.

Most of the world's equipment producers operate under the former set of economic criteria, producing

ever more expensive machinery which requires ever fewer operators with ever more extensive technical training. But 8-mm film is one technology which runs counter to this trend. Its origins in 'home movies' provide a sufficiently large market to warrant mass production of equipment, which means low unit costs. The amateur's desire to experiment has resulted in the development of a range of do-it-yourself' gadgets which can often match the highly professionalized services of 16-mm film.

As purely technical demands on their time decrease, film communicators everywhere can concentrate their energies on the more important non-technical matter of creating exciting and effective messages for well-designed film applications. And wherever film and television industries have invested less in older film formats, the role of 8-mm film will be far greater. In the non-industrial countries especially, there is a rare opportunity for innovation.

Chapter I

8-mm film and its context

Film viewing can be a very vivid and stimulating experience. The medium can portray virtually any sight human beings can see and any sound one can hear. In addition, film has many devices for heightening experience beyond the sights and sounds of real life. Editing of film footage allows the viewer's perspective to shift instantly in time and space. In a split second, the scene may shift from a long shot of characters in a landscape to close-ups of characters' faces as they speak. Voices can be synchronized with the image, or dissociated from the image as in the case of narration. Sound effects and music may be mixed with voices to add realism and emotional power to a scene. Fades, dissolves, superimpositions, animation, pixilation, time lapse and other visual techniques offer film a range of techniques for going beyond life's experiences in sound and sight.

These techniques have developed through the tradition of feature film production on 35 mm. Films which make full use of these techniques are corporate enterprises involving many man-years of labour on the part of specialized technical and artistic personnel.

Several hundred people work on the average feature film, which costs upwards of U.S.$1 million. Quality-film programming for television generally costs between $50,000 and $200,000 per hour. This level of expense and organization has been required to produce film of the technical quality that cinema and television patrons expect.

The change to 16 mm

Until relatively recently, most film was shot in the studio, with large technical crews using mammoth equipment to film professional actors in fabricated plot situations. Escape from the studio and into the filming of real people in real situations was facilitated by the introduction of portable 16-mm sound cameras. This new equipment, which could be operated by a crew of two to four people, made possible the *cinéma vérité* approach of filming reality with the least possible intrusion by the camera. This is one example of how hardware and software interact. New communication styles and subjects develop as technical bottlenecks involving equipment are removed.

However, even in 16-mm *vérité* filming, some vestiges of the feature-film tradition remained after the introduction of the new equipment. This equipment is expensive and difficult to operate, although less so than traditional studio equipment. A professional, although much smaller crew, is still required to operate this equipment. These obstacles to modest, unpretentious filming were not removed until the introduction of inexpensive, automated 8-mm equipment of sufficient quality to permit serious film-making.

The 8-mm revolution

The introduction of 8-mm equipment has enabled film communicators to venture even further from the feature-film tradition. 8 mm has expanded the range of people and institutions who can gain access

to the film medium and as a result has removed many of the constraints on film style and content. A few examples of 8-mm film application will provide the most eloquent introduction to the potential of these new formats.

Professional film and television crews did not document the tragic assassination of the American President John F. Kennedy. 8-mm 'home movies' of the event were shot by an amateur film-maker, who thought he was merely recording the arrival of the president. 8 mm was the only film format which happened to be participating spontaneously in the presidential parade when the tragic events occurred. The 8-mm images were later reproduced as still photographs in mass circulation news magazines, and as moving pictures in film and television documentaries. In the years since the assassination, 8-mm film equipment has become an ubiquitous observer of events in the industrialized countries.

The German adventurer Rollo Gebhardt used 8-mm film to document his round-the-world sailing voyage, and later showed his film on television in the Federal Republic of Germany. 8-mm equipment is inexpensive enough that non-professionals can purchase their own equipment. Thus, 8 mm could be an intimate companion for months while waiting to film the highlights of the voyage. Professional equipment and professional crews, with their high costs, could not have operated on this basis.

In December 1972, a major New York television station broadcast exclusive news features on the aftermath of the Nicaraguan earthquake. These features consisted of film shot by an American doctor who was part of the relief effort, and who had not had previous experience in film. Before travelling to Nicaragua, the doctor had been equipped by the television station with super-8 equipment and given verbal instructions on how to shoot film. The doctor mailed the exposed film to New York, where the footage was edited by station professionals. The result was a unique film statement by a participant in a human tragedy.

Recently, an 8-mm documentary was shown for the first time on American national public television. The film probed the violent death of a Texas blues singer in the 1930s. Friends and relatives of the singer spoke to the camera in an intimate and natural manner. The more imposing, more intimidating presence of professional film equipment and crew would not have been as well suited to spontaneous expression by non-actors.

The characteristics of 8 mm

These vignettes illustrate some of the unique features of 8-mm film as a production medium. 8 mm can be shot by amateurs. 8 mm is ubiquitous, and is often present when noteworthy events occur. 8 mm can wait around where such events are likely to occur. 8-mm equipment is non-threatening to people, and encourages spontaneous, unaffected, and intimate expression.

These features derive directly from the nature of the hardware. 8-mm equipment is portable, unobtrusive and inexpensive. As a result, 8 mm puts fewer technical and financial obstacles between film-maker and reality than do 16-mm or 35-mm film. Compared to these formats, 8 mm produces relatively low-definition, unglamorous images, which are suited more to documenting than to dressing up reality. In essence, 8 mm is a reality-based medium.

The 8-mm medium offers spontaneity in content and style which compensates for its lower image quality. The significantly lower costs of 8 mm can also allow increased volume of film production for educational and developmental objectives in many countries. And for some non-industrialized countries, a limited amount of film work in 8 mm will be possible, whereas none was possible in the older, more expensive formats.

The above statements apply to 8 mm generally, and should not be taken to mean that 8 mm will apply to all film and television communication pro-

jects. While project planners may share these hopes for the over-all impact of 8 mm, they must defer judgement of the medium's applicability to any specific situation until the end of a rigorous planning process.

The development of 8 mm

Today's 8-mm film incorporates two millennia of technological advances contributed by great minds from many cultures. The ancient Greek scholar Archimedes is said to have produced the first lens. A thousand years later, the Arab scientist Alhazen first explained many basic optical phenomena. After another 500 years the *camera obscura* was invented by Leonardo da Vinci. In the nineteenth century, the development of still photography was propelled by the Frenchman DaGuerre. At the end of the nineteenth century, the American inventor Thomas Edison synthesized many innovations to produce the first motion-picture camera and a practical projector was developed by the French Lumière brothers in 1895.[1]

Edison's camera shot rapid sequences of still photographs called *frames*. When projected at the same speed they had been shot, still pictures were perceived as continuous motion. The first film format designed by Edison was 35 mm wide. This gauge rapidly established itself as the professional standard. In order to create a more economical film medium for non-professionals, 16-mm film was introduced by Eastman Kodak Company in 1923. The format was at first scorned by professionals, and did not generate an amateur film market.

In fact, 16-mm film did not begin to gain acceptance as a professional medium until the Second World War, when lighter, more portable equipment than 35 mm was needed by military forces, whose

1. For a fascinating recounting of the development of film technology, see Melvin L. De Fleur, *Theories of Mass Communication*, p. 23–35, New York, N.Y., McKay, 1970.

specifications spurred further improvement of 16-mm equipment. By this time, the quality of film emulsions had improved as well, and 16 mm could provide technically better images than had been possible two decades earlier.

Since 16 mm had not initially found acceptance with amateurs, an even more economical amateur film format was introduced in 1932. The *double 8-mm format* used half the frame of standard 16-mm film. After passing through the 8-mm camera once, the film was reversed, and re-exposed on the other side of the film. After processing, the film was slit

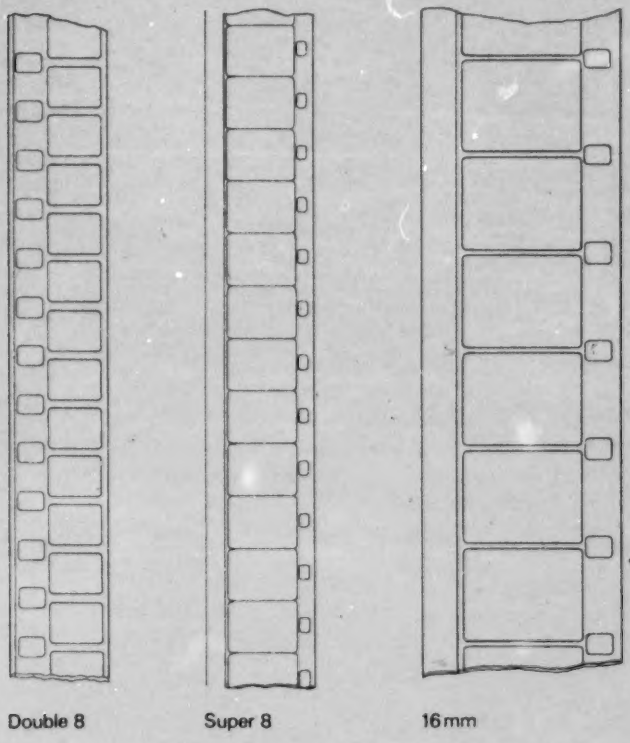


FIG. 1. *This comparison shows the differences in frame size and sprocket position of double-8, super-8 and 16-mm film. In super 8, as in 16 mm, the sound stripe is opposite the sprocket holes.*

down the middle. Since the image size was reduced vertically as well as horizontally, the 8-mm user obtained not two but four times as much running time from a given length of film as did the 16-mm user.

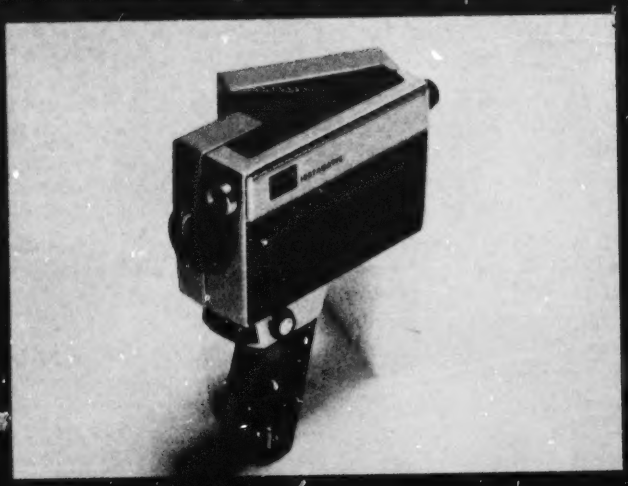
Whereas 16 mm had not succeeded in developing an amateur market, 8 mm most certainly did. 'Home movies' became a common family diversion in the industrialized countries. However, 8-mm users complained of the difficulty of threading and rethreading film into the camera. Furthermore, the double 8-mm format often meant low image quality due to small image area and faulty exposure.

Gradually, the growth in sales of 8-mm equipment and film began to lag. In order to deal with the complaints of 8-mm users, and to stimulate the amateur film market, a new film format was introduced in 1964. *Super-8 film* offered features which had not been available in any previous film format. To eliminate loading problems, super-8 film was packaged in cartridges, which went into the camera quickly and with no chance for error. The film was cut 8 mm wide, and was designed for a single pass. When the film was exposed, the cartridge was simply taken out of the camera and sent to the laboratory.

To eliminate exposure problems, super-8 cameras were equipped with built-in light meters and automatic exposure control. After minimal instruction on how to correct for difficult lighting situations, anyone could produce acceptably exposed images.

To improve image quality, the frame area of super 8 was enlarged approximately 50 per cent over that of double 8 mm. This was achieved even though the width of the film remained 8 mm. The sprocket holes used to advance the film were reduced and rotated so as to use less of the film area.

There is still some controversy regarding the degree of improvement which has resulted from the change to super 8. Some purists continue to use double 8, although double-8 equipment is no longer manufactured, and double-8 film is increasingly difficult to obtain. Double-8 users feel that their images are of equal quality to those of super 8.



An example of a low-cost 8-mm camera with minimal accessories. Courtesy of Eastman Kodak Co.

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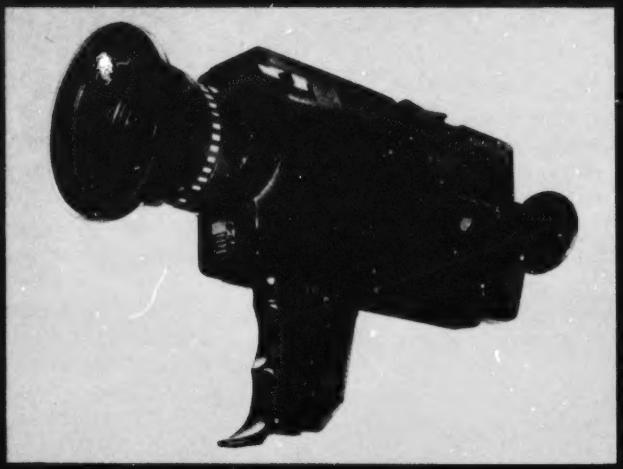
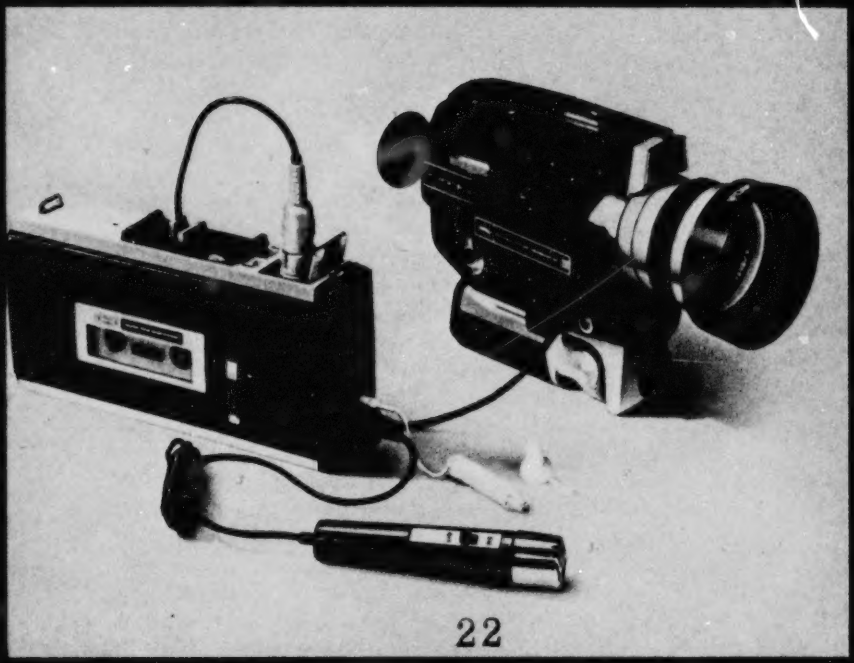
Loading the M-22 super-8 cassette with film. All manipulations can be performed by simple motor. Courtesy of Eastman Kodak Co.



The Eumig mini 7 camera has six XL zoom lens with macro adjustment. (Courtesy of Eumig Corporation.)



The double-system Elmo 1 up has a single 7 camera with sound capability and a cassette recorder. (Courtesy of Elmo Corporation.)

They maintain that the plastic pressure plate which holds cartridge super-8 film against the camera's film gate is less steady than the in-camera metal pressure plate of the double-8 format. As a result any increases in image quality which derive from super 8's increased image area are cancelled out by super 8's inferior pressure plate.

Fortunately, an 8-mm format has developed which combines the advantages of super 8's larger image area with double 8's in-camera metal pressure plate. *Double super 8* (DS8) uses 16-mm wide film adapted for two passes through an 8-mm camera. The film comes not in cartridges but on 16-mm wide reels. DS8 offers a wider range of film types than super 8 which includes one professional 16-mm emulsion, Ektachrome commercial ECO 7252.

The initial double super-8 cameras were modified 16-mm cameras. As a result, these cameras (as well as the subsequent double super-8 cameras of original design) are more rugged than most super-8 cameras. Of course, these cameras are correspondingly more expensive.

One final 8-mm production format must be mentioned. *Single 8*, developed by the Fuji Corporation, is identical to super 8, except for the film cartridge design and the film base. Whereas super-8 film uses an acetate base, single 8 uses polyester. Polyester is stronger and thinner than acetate. Both these features are advantages in film projection. However, polyester-based film is more difficult to splice than acetate, which is a disadvantage in production.

Until recently, polyester-based film could only be spliced with tape. Currently, sonic splicers are available (at high cost) for splicing polyester without tape. Certain new types of cement are said to glue polyester; however, they are expensive and highly toxic. In short, Fuji's single-8 polyester-based film is generally seen as having slight disadvantages in production and advantages in projection.

The second difference between single 8 and super 8 is the design of the film cartridge. Instead of the coaxial design of the super-8 cartridge, single 8

uses two reels in a vertical configuration. This cartridge is less complex and less subject to malfunction. It also permits flexible manual backwinding for double exposures and dissolves while super 8 allows only limited backwinding. Single 8's metal in-camera pressure plate is said to produce slightly steadier and sharper images than super 8. On the other hand, the super-8 cartridge loads more quickly and easily, and has found greater acceptance among camera manufacturers. In fact, only Fuji manufactures single-8 cameras.

The coexistence of three current incompatible production standards for 8-mm film should be seen in its proper perspective. Film footage on super 8, single 8 and double super 8 can be edited together and shown on virtually any current 8-mm projector. Sound in 8 mm is remarkably standardized upon magnetic recording displaced eighteen frames ahead of the corresponding picture frame. Although optical sound exists in super 8, it is used very rarely. On the other hand, 16-mm sound has two standards (optical and magnetic) which are in wide use. Furthermore, 16 mm suffers from additional standardization problems. 16-mm film sometimes comes with perforations on one side of the film, sometimes with perforations on both sides. Film is available on different types of cores and reels. The three current standards in 8-mm film, seen in relation to 16-mm standards, do not pose insurmountable problems.

Types of film

Over the years, a variety of film types have been developed to meet the needs of 16-mm and 35-mm film-makers. This progress has benefited the variety and quality of 8-mm films as well. 8 mm is available in black and white or in colour. Some films are colour balanced for shooting indoors with tungsten lighting. Others are balanced for use outdoors in natural daylight. Special films are manufactured for use in brightly lit situations and dimly lit situations. Films to cover all these situations exist in all current 8-mm film formats.

TABLE 1. Selection of 8-mm film generally available

Film	Light source	Film speed (ASA number)	Super-8 cartridge (15.2 m)		Super-8 cartridge (61 m)		Super-8 single strand on Kodak movie reel (61 m)		Double super 8 on spool (30.5 m)	Single-8 cartridge (15 m)
			Silent	Sound	Silent	Sound	Silent	Sound	(Silent)	(Silent)
Agfachrome	Daylight (filter)	25	X	.	.	.	.	.	.	.
	Tungsten (no filter)	40								
Kodachrome 25 movie Film (daylight)	Daylight (no filter)	25	.	.	.	.	.	.	X	.
	Tungsten (filter)	8								
Kodachrome 40 movie Film (type A)	Daylight (filter)	25	X	X	.	.	.	.	X	.
	Tungsten (no filter)	40								
Kodak ektachrome 40 Movie film (type A)	Daylight (filter)	25	X	.	.	.	.	.	.	.
	Tungsten (no filter)	40								
Kodak ektachrome 160 Movie film (type A)	Daylight (filter)	100	X	X	.	.	.	.	.	.
	Tungsten (no filter)	160								
Kodak type G ektachrome 160 movie film	Daylight (no filter)	160	X	.	.	.	.	.	.	.
	Tungsten (no filter)	160								
Kodak ektachrome EF Film 7242 (tungsten)	Daylight (filter)	80	X	X	X	X	X	X	X	.
	Tungsten (no filter)	125								

Kodak ektachrome SM Film 7244 (type A)	Daylight (filter) Tungsten (no filter)	100 160	X	X	X	X	X	X	.	.
Eastman ektachrome Commercial Film SO-425	Daylight (filter) Tungsten (no filter)	16 25	.	.	.	.	.	.	X	.
Fujichrome R25	Daylight (no filter)	25	.	.	.	.	.	.	.	X
Fujichrome RT 200	Daylight (filter) Tungsten (no filter)	160 200	.	.	.	.	.	.	.	X
Fuji pan R50	Daylight Tungsten	50 50	.	.	.	.	.	.	.	X
Fuji pan R200	Daylight Tungsten	200 200	.	.	.	.	.	.	.	X
GAF	Daylight (filter) Tungsten (no filter)	25 40	X		.	.	.	.	.	.
GAF 500	Daylight Tungsten	500 500	X		.	.	.	.	.	.
Kodak plus-X Reversal Film 7276	Daylight (filter) Tungsten (no filter) Daylight (no filter)	25 40 50	X		.	.	.	.	X	.
Kodak tri-X Reversal Film 7278	Daylight (no filter) Tungsten (no filter)	200 160	X		.	.	.	.	X	.
Kodak 4-X reversal Film 7277	Daylight (no filter) Tungsten (no filter)	400 320	X		.	.	.	.	X	.

It should be noted that the above types of 8-mm films are designed for shooting positive reversals in the camera which when processed become the final print without passing through the negative stage. It is possible to make extra film prints from a *positive reversal*, but processing is tricky and not without losses in tone and increase in contrast.

In the professional gauges, there exist matched pairs of film types, one for shooting (the *negative*), one for printing (the *positive*). These films complement each other's characteristics, and produce prints of high quality. 8 mm lacks this type of sophistication in printing even in the industrialized countries. None the less, a broad range of 8-mm films for shooting is available (see Table 1 for a selection of films generally available).

In some industrialized countries the range and composition of the 8-mm film market varies. In many non-industrial countries taxation and importation laws discourage the stocking of different films from different manufacturers. Eastman Kodak both sells and processes 8-mm films in twenty-five different countries, seven of which are non-industrialized countries. Kodak has representatives in most other countries of the world, which offer processing services by forwarding film to Kodak laboratories in neighbouring countries. Fuji has also sales representation in many countries, and has 8-mm processing facilities in eleven countries, of which one (Indonesia) is non-industrial. Although corresponding information was not readily available from other film manufacturers, the above information supports the conclusion that 8 mm is truly an international medium available in many countries of the world.

This initial introduction to the 8-mm film formats documents the growth of motion pictures from their appearance near the turn of the century through the introduction of double 8 mm in 1934 and the introduction of super 8 in 1964. Since that time, the dramatic innovations in the medium have been largely in the realm of hardware.

Chapter II

The range of 8-mm hardware

The technical side of film-making is best treated as a series of discreet functions handled by a mix of hardware and skills. The sequence of tasks is: production planning, location recording, film processing, sound transfer, editing, sound mixing, display and distribution. Each of these functions can be fulfilled at a number of levels of sophistication and expense. This chapter will cover the major equipment options currently available to the 8-mm film-maker.

Cameras

Although 8 mm cannot compete with the more established gauges in film availability, 8 mm offers a far greater range of choice in cameras. At the 1974 Fotokina show of photographic equipment in the Federal Republic of Germany, there were 120 different 8-mm camera models on display. Prices ranged from $30 for the simplest to over $2,000 for the most sophisticated super-8 camera. The prestige manufacturers of 16-mm equipment, Arriflex and Eclair,

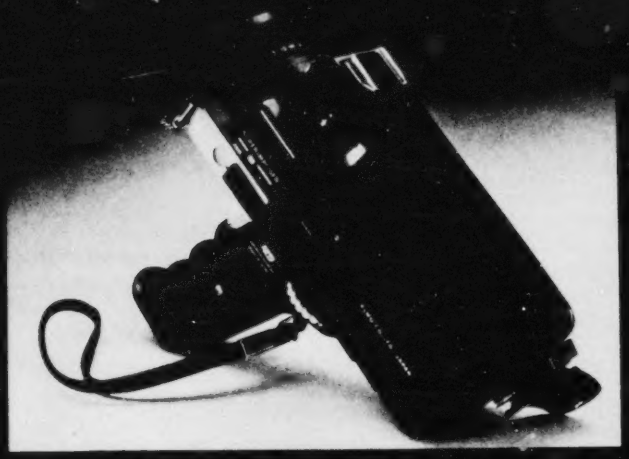
showed 8-mm prototypes which are expected to cost around $5,000, if and when they are commercially produced. Although this last figure may sound high, top 16-mm cameras of these companies cost almost $15,000. Professional 35-mm cameras cost up to $50,000.

The M-22 ($25–$35) produces images which are technically excellent, according to one of the leading writers on film technology.[1] Of course, the features of the camera are minimal. The lens, although very sharp, is limited to one fixed focal length. The camera does not have a light meter, or an automatic exposure system. The M-22 drive system is said to be rock steady, although it is limited to one filming speed. The M-22 is an economical tool for training or for incorporating filming by non-professionals into a serious film product.

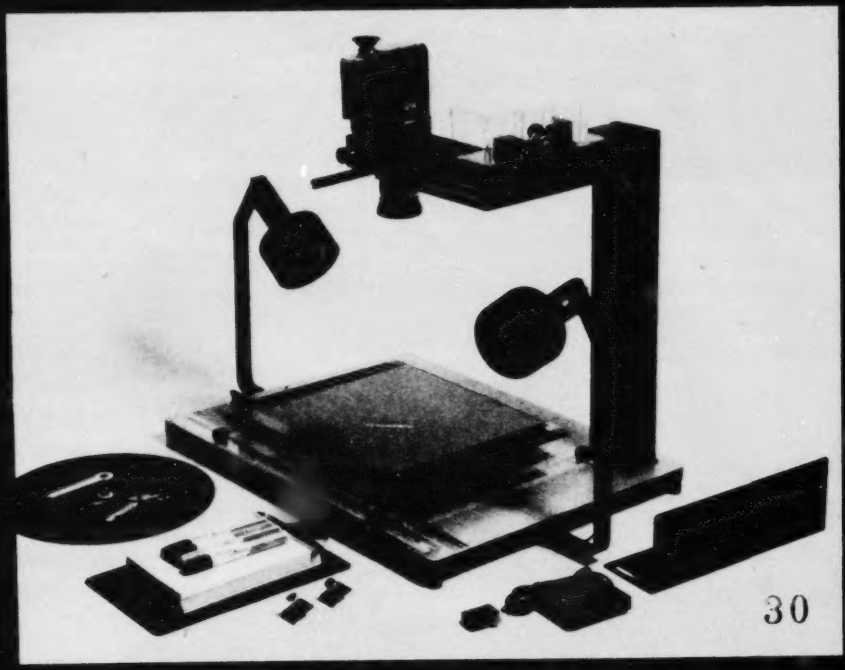
More expensive 8-mm cameras incorporate automatic exposure control, motorized *zoom lenses*, which can smoothly change their focal length from wide angles to close-ups of distant subjects. These features are available only as expensive accessories on most 16-mm and 35-mm cameras.

Many super-8 cameras have features which other formats offer only on specialized equipment. Some 8-mm cameras have *macro-focusing lenses* which give clear pictures of objects which are very close to the camera. This feature allows extreme magnification of small objects; the Elmo 204-T even has an adapter for filming slide titles. Many super-8 cameras can expose single frames of film, which permits animation (simulated motion) of inanimate objects or drawings. Furthermore, some cameras contain automatic timers (called intervalometers) which expose single frames at pre-determined intervals. This feature permits regularized *time-lapse* filming in which long periods of time are dramatically condensed. Such processes as the opening of a flower or one day's cloud movements can be shown as brief motion pictures. Finally,

1. Lenny Lipton, *Independent Filmmaking*, p. 124, San Francisco, Calif., Straight Arrow Press, 1973.



The Elmo 201U "Super-imposer" can perform regular dissolves, close ups, and titling superimposed on live action. [Courtesy Elmo Corporation.]



This is the simplest of animation tables, but provides light control, camera movement, and adjustments of graphics plate. [Courtesy of Oxberry Corporation.]

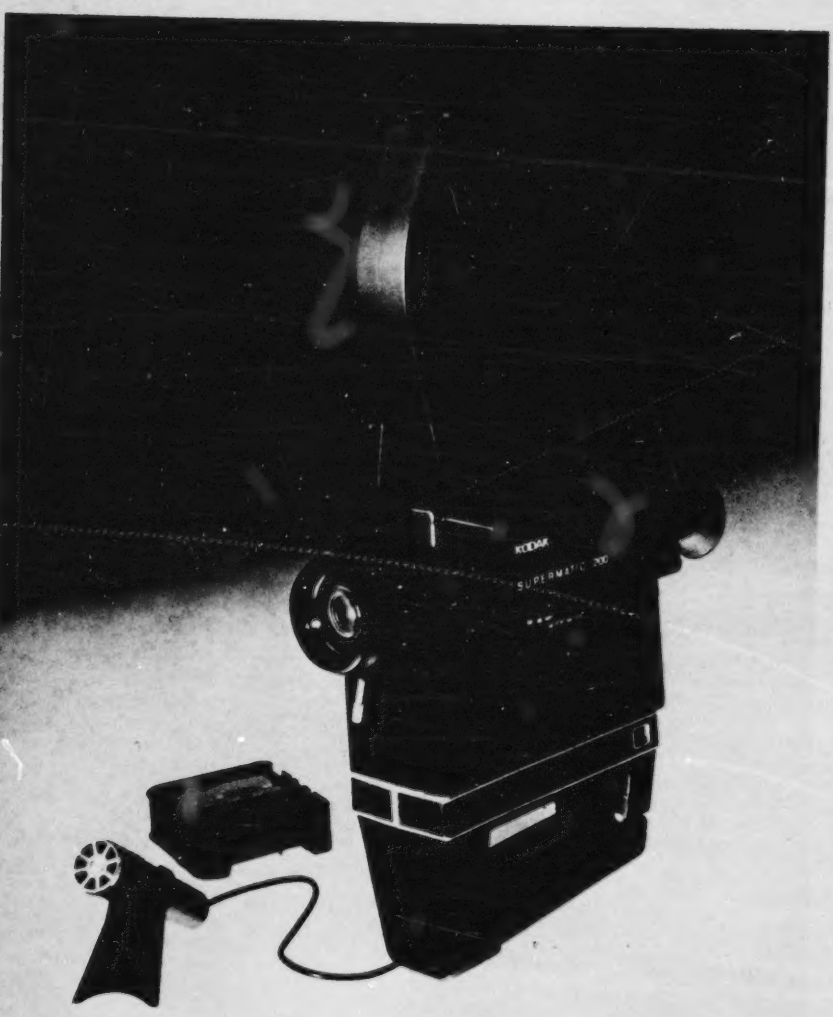
other cameras can produce standard visual effects such as slow *fades* to black, *dissolves* from one image to another, and *superimpositions* of one image over another. Each of the above capabilities can be obtained with 8-mm equipment costing under $600. These are especially important features, since 8-mm laboratories cannot always process fades, dissolves, and supers without some loss in colour and print quality (see also page 62 under '8-mm Open-reel Prints').

A final 8-mm feature which is worthy of mention is the existing light or *XL (existing light)* camera. Costing as little as $100, these cameras allow filming in very dimly lit situations without additional lighting. This is achieved through a highly light-sensitive lens, a special shutter design, and a capacity for new low-light films. Some XL cameras also have a viewing system which is light-efficient. These features are only available as expensive accessories on 16-mm or 35-mm cameras.

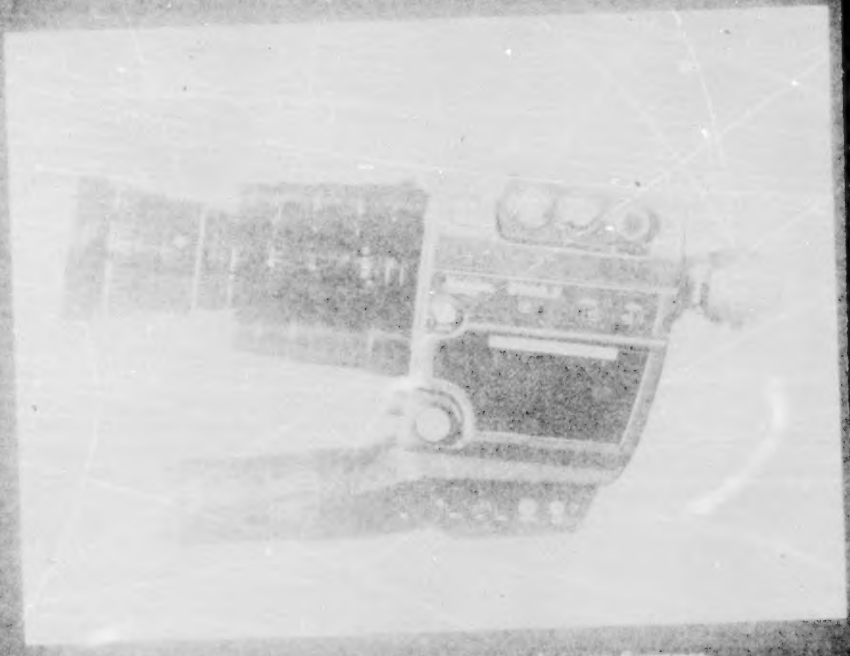
Sound synchronization

In recent years, 8-mm cameras have also been developed which can record sound in synchronization with the visual image. There are two different approaches to *sync filming: double-system* and *single-system*. The former uses a sound recorder which is separate from the camera. The single-system approach incorporates a sound recording head in the camera itself and records on a magnetic stripe along the edge of the film. Single-system equipment has only become available very recently. After the basic $200 models were introduced by Kodak, other models offering quieter operation and more features have been introduced by several manufacturers with prices beginning around $350.

The full capabilities of super-8 cameras are most dramatically illustrated in the new Beaulieu 5008-S single-system camera. The camera has a high-quality lens with a very long zooming ratio (6–80 mm). The lens can also make extreme close-ups of small objects.



For single-system film recording, the Supermatic 200 records sound on the magnetic stripe of the film. [Courtesy Eastman Kodak Co.]



The Bauer 1000 is one of the most expensive super-8 cameras, but incorporates highly professional features such as single or double-system sound recording, an extremely high-quality lens with a long zooming ratio (6 to 66 mm), plus macro capability.
[Courtesy of Bauer Corporation.]

The camera has existing light capacity, and records excellent quality sound on the edge of magnetically striped film. Alternatively, one may also record double-system sound. These capabilities are contained in a camera which weighs 5½ lb and costs in the region of $1,600. Comparable features in 16 mm may weigh about three times as much and cost at least six times as much.

To date, the 16-mm and 8-mm cameras have had but one area of direct overlap. Some double super-8 cameras are modified 16-mm cameras. Features mentioned in the previous chapter need not be repeated. Double super 8's ability to use magazines containing up to 26 minutes of film and its compatibility with established 16-mm double-system practices are worthy of mention. The new Pathe EDP camera offers these features at a price of $2,300.

Double-system sound recorders

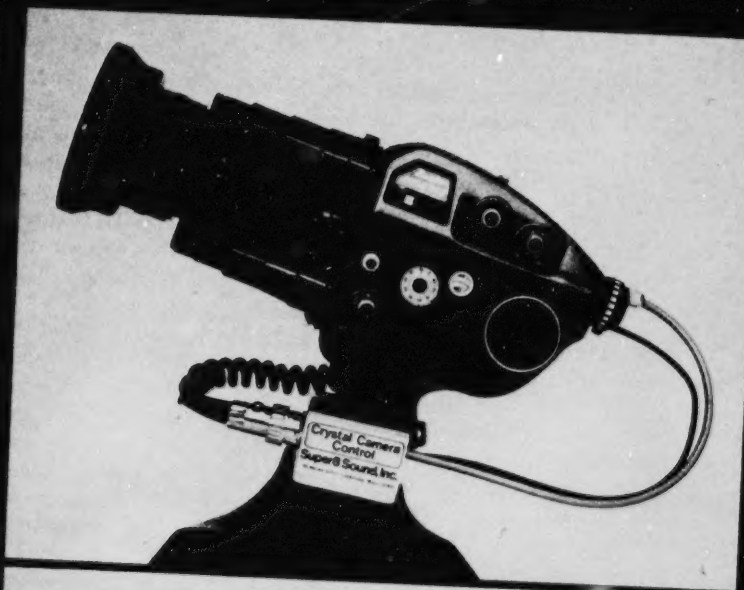
There is at present a confusing array of systems for synchronizing sound recorders and cameras. At Fotokina there were no less than twenty-three different systems on display. Only three of them are generally recognized as serious communication tools: the Erlson system, the Inner Space system and the Super-8 Sound system. The other twenty systems fail to permit flexible frame-for-frame editing of sound and picture, which is necessary for maintaining synchronization during editing.

The Erlson system uses the electronic flash contact included in most quality 8-mm cameras to send to a modified Uher tape recorder an electronic pulse, which is later used to match sight and sound. The other two systems under consideration operate under similar design premises, but incorporate electronic *feedback* circuitry to compensate continuously for slight fluctuations in running speed. These two systems are interesting, in that they utilize more modern technological principles than the standard 16-mm and 35-mm synchronization systems.

The backbone of the Inner Space system is the Cine Slave unit, a small black box that establishes and maintains synchronization between virtually any recorder and any camera, according to the manufacturer. This system is used by 16-mm as well as 8-mm film-makers. The camera drive is generally *slaved* to the more accurate drive mechanism of the sound recorder. The Cine Slave is also available with two crystal clocks which regulate running speeds without requiring a cable connexion between camera and recorder. This feature is often useful for *vérité* filming in fast-moving situations where camera and sound operators need to move independently. Incidentally, the company claims to have sold many Cine Slave units in tropical countries because of the special coating which protects the circuitry against heat and humidity.

The main component in the Super-8 Sound system is the Super-8 Sound recorder, a remarkably versatile and compact machine which fills a number of location, transfer, editing and projection functions. Using sync cables developed by the company, the recorder can slave itself to the speed of virtually any piece of hardware from any manufacturer. For location filming, cables can be eliminated, since the machine has an internal crystal clock. For this application, the camera to be used must be fitted with their crystal camera control. The company's emphasis is upon developing methods for integrating equipment from different manufacturers into comprehensive film production systems.

While large manufacturers develop mutually incompatible systems, Super-8 Sound stresses standardization. The company has modified several cassette recorders for sync location filming. They have also developed a crystal control package for converting a variety of cameras and cassette recorders from diverse manufacturers to cableless sync filming. Cassettes recorded in this way are then transferred via the Super-8 Sound recorder to a recording medium which can be edited on equipment from a variety of manufacturers.


Crystal Camera
Control
Super8 Sound, Inc.

Super8 Sound

Electra in France has designed two sync sound recorders which are modified Sony's with quartz pilot control, but at higher prices. The Auto Quartz, at an export price of $2,000 plus, offers crystal sync sound with any super-8 camera fitted with an electronic flash contact. This model (Sony TC-510.2) comes adaptable for 8-mm fullcoat or ordinary open-reel tape, including chrome-dioxide coated tape for improved sound rendition. The Diamant is a similarly adapted model but built around the Sony TC-142 cassette and priced at about $1,000.

Another technical problem with 8-mm cameras has been their high operating noise levels. During indoor filming, this often impairs sound quality. To solve this problem, Super-8 Sound developed a cheap silencer made of leather, foam and lead. Significant noise reduction can be attained for cameras from many manufacturers at a small fraction of the price for 16-mm camera silencers (about $100). This type of inventiveness on the part of such small, dynamic organizations is forcing large equipment manufacturers to come to terms with the demand for standardization and professionalization in 8-mm.

Lighting

Motion-picture lighting is a complex art which has provided the basis for entire careers in the feature-film industry. Independent film-makers have often avoided artificial lighting in favour of using the available light of the scene being filmed. What attitude should the systematic 8-mm film communicator take with regard to artificial lighting?

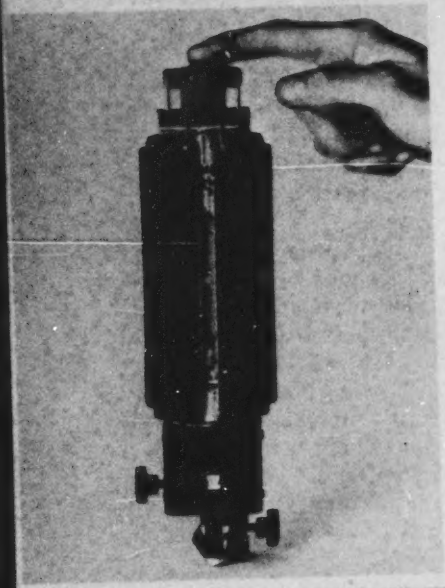
Given the availability of XL (existing light) cameras, many users of 8 mm have abandoned supplemental lighting altogether. However, in the words of Gunther Hoos of the Super-8 Film Group, the fact that XL cameras can always produce some kind of image does not guarantee an acceptable or pleasing image. Clearly, lighting decisions should be made according to the specific conditions in which one is

filming. To entirely disregard the tools of the lighting technician would be to deny oneself a basic film resource. On the other hand, to use cumbersome and expensive lighting equipment would be to destroy the spontaneous, unobtrusive and inexpensive characteristics of the 'modest medium'.

There are several portable, inexpensive options for movie lighting which should be considered by the 8-mm film-maker as part of his of her arsenal of equipment. The simplest and cheapest method is to replace common household light bulbs with high intensity *photo-flood lights*. Prices for these bulbs begin at $0.60. Since they can be inserted in existing light fixtures, many indoor locations would not require special light stands. Using existing light fixtures also has the advantage of leaving the scene intact, and filming as things appear naturally, although with the benefit of heightened light levels.

In some instances, the film-maker may want to use special photo-flood light stands in order to gain added control over light placement. A simple kit including three such stands costs about $55. Higher intensity, longer lasting *quartz lamps* begin at a cost of $16. A small portable quartz unit costs $50. A full-blown kit using this light costs $675. At this price, however, the 'modest' quality of the 8-mm medium begins to be compromised.

Supplemental lighting always reduces spontaneity and unobtrusiveness to some degree. Complications involving power limits of electrical circuitry must be dealt with. Non-actors feel uncomfortable under the glare and heat of movie lights. However, modest lighting equipment can sometimes be helpful. Although the humble photo-flood is scorned by many professional film-makers, it serves as an illustration of reasonable lighting quality which can be obtained with remarkable ease and at low cost.



The Lowell Tota-Light quartz lamp. [Courtesy of Lowell Lite Manufacturing Corporation.]

The Kodak supermatic automated super-8 film processor. Peculiarly shaped plastic containers prevent pouring wrong chemicals into the bin compartments. [Courtesy Eastman Kodak Co.]

Film processing

The next technical task after location filming is film processing. There are two major options for solving this problem: doing it oneself or using commercial processors. The latter solution is the least involved, provided that quality service is conveniently available. The only certain way of checking this alternative is to write to major film manufacturers concerning their local representation, and to submit a few rolls of film for processing.

If commercial processing proves too slow, too high in price or too low in quality, there are a number of methods for developing one's own film. The alternatives range from manual developing tanks costing from $50 to a fully automated processor costing $12,500.

The least expensive solution, the manual developing tank, costs between $50 and $200. Loading exposed film into the tank, mixing and applying the sequence of chemicals are not difficult. With some practice, quality black and white developing can be done by anyone who has an ability to follow directions and to work meticulously. Colour processing, however, is a more complicated matter.

Colour chemicals must be used at the precisely controlled temperatures. Proper agitation of the film during development is important. Acceptable colour quality can be obtained with some practice, although perfect colour rendition is difficult to achieve. Manual film development is also rather tedious and time-consuming. With commercial processing easily available, most film-makers in industrialized countries do not bother to do their own processing. In non-industrialized countries, where processing is less available and where labour is inexpensive, film-makers may choose to hire and train staff to process their film manually.

Many firms offer machine processors which can produce quality colour film. These range in price from

$1,000 to $12,500. Most of these machines require a skilled operator. Ironically, the most expensive of them may prove of most interest to 8-mm film-makers, since it can be operated by personnel without elaborate technical training.

The Kodak automated 8-mm colour processor (reversal film only) is a remarkable machine. Its installation requires only a 220-volt electrical outlet, a cold-water source, and a drain for discharging used chemicals. The machine operates in daylight. Chemical concentrates are coded by colour and by the shape of the bottleneck, so that they cannot be inserted into the wrong part of the machine. After chemicals are inserted, the machine mixes its own concentrates, develops films (100 cartridges of 50 feet) and signals when the chemicals are exhausted. With the press of a button, the machine flushes out the old chemicals, washes itself, regains proper water levels, and signals the operator to insert the new chemical concentrates.

One disadvantage of the machine is that it processes only one film type (Ektachrome 7244, colour reversal) which was developed especially for this machine. No other colour or black-and-white films can be used, since they are not prehardened for the machine's high processing temperatures.

The manufacturer claims that if the machine is kept relatively busy, it can repay its costs in a couple of years from savings over commercial processing rates. Although the use of such a capital-intensive technology may be unacceptable to many planners in countries which are starved for capital and jobs, the automated processor does offer guaranteed colour quality which is otherwise difficult to obtain.

Sound transfer

In order to have precise frame-for-frame control over sound in editing, film-makers use *fullcoat*, a magnetic recording tape with the same width and perforations of super-8 film. In this way, sound and picture are on separate media of identical length, and can be cut

at precisely corresponding points. In most cases, sound must be transferred from the original location sound medium to fullcoat.

Single-system sound

When sound has been recorded on a magnetic stripe at the edge of the film, it is possible to project the film, and even to edit the film without sound transfer. However, this approach has a drawback. For technical reasons, single-system sound is recorded with an eighteen-frame displacement ahead of the corresponding picture frame.[1] When two pieces of striped film are spliced, the sound corresponding to the new picture does not begin until eighteen frames after the splice. Depending upon filming speed, this will amount to either 1 second or less without sound. In many cases, this technical deficiency is a small price to pay for the ease, speed and economy of single-system film-making.

However, in some cases, such as scenes of dramatic films which involve dialogue, momentary loss of sound can impair the flow and impact of the film. Therefore, many film-makers choose to transfer the sound from the stripe to a fullcoat, which allows frame-for-frame editing of both sound and picture. This is done by projecting the film in a sound projector which emits pulses to which a fullcoat recorder can slave itself.

Double-system: cassette or reel tape

Cassette and ¼ inch reel-to-reel location recorders receive and record once-per-frame digital pulses from the camera. Fullcoat recorders such as the Super-8 Sound recorder read and regulate their speed by these pulses as they re-record the sound on to fullcoat.

1. Moser Development Company does offer a 'displacement recorder' for $1,500 which repositions single-system sound on the stripe opposite the corresponding picture frame, in order to permit frame-for-frame single-system editing. After editing, sound is once again transferred to projection sync eighteen frames from the corresponding visual frame. However, with each rerecording of the sound, one must expect some loss in sound quality.

Fullcoat tape

Some film-makers use fullcoat recorders (such as the Super-8 Sound recorder) as location recorders. This approach has the advantage of producing original recordings which are ready to edit. The disadvantage is the increased size and weight of the fullcoat recorders (12 lb).

Other approaches

Other systems have been developed which eliminate the transfer of sound to fullcoat tape: the Inner Space electronic editing system, the Optasound Estec, and the French Vaast equipment. These systems transfer and edit sound electronically, passing directly from original recording to final sound track. Since they are not compatible with the emerging standards in 8 mm, these systems have not received broad acceptance among 8-mm film-makers. However, the future development of these systems should be noted.

Editing

After both sound and picture have been prepared for editing, there begins a very important stage in the 8-mm film-making process. The low cost of 8-mm film encourages its use in films which are not tightly scripted, and which have high shooting ratios (which is to say that much more film is shot than will be used in the final product). In 8 mm the film editor is likely to have a great influence on the film, sifting through great lengths of relatively unstructured films. Thus the 8-mm film editor assumes a major creative role which goes far beyond physical cutting and splicing of film and into energizing the flow and pace of loosely scripted or non-scripted film.

The creative function of the editor can be discharged effectively only if adequate hardware is available to facilitate the nuts-and-bolts aspects of

editing. Until recently, 8 mm was rightly criticized by film professionals for not having developed such hardware. Finally, these problems are being resolved. In the last few years, a number of satisfactory alternatives have been developed for editing efficiently at varying levels of expense and sophistication.

Single-system editing

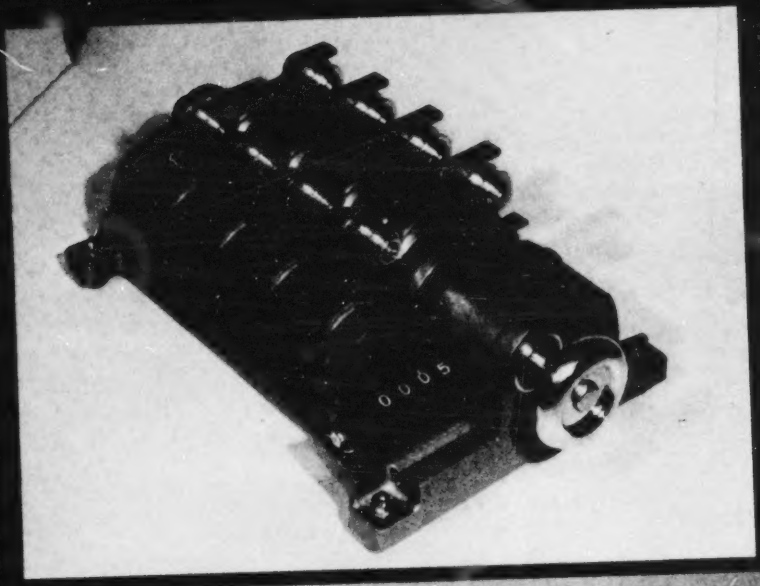
The simplest, quickest and cheapest type of 8-mm sound editing is strict single-system editing, which involves cutting sound film with the original sound recording on the edge stripe. This method has two drawbacks.

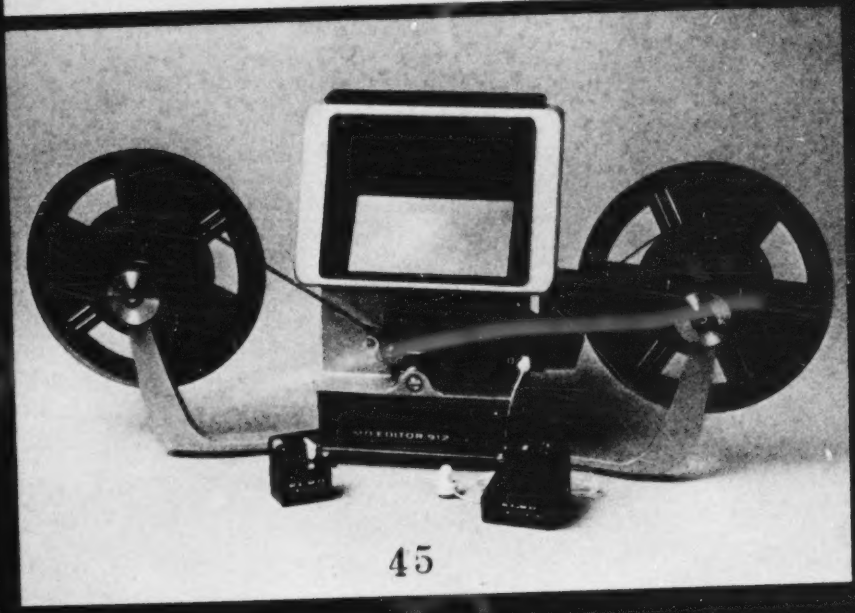
As mentioned above, there is an eighteen-frame lag between any given point on the sound stripe and its corresponding picture frame. This means that the first eighteen frames of new picture after each cut are accompanied by sound from a previous scene. Although this unwanted sound can be erased, there are no simple ways of providing sync sound for the first eighteen frames of a new shot. This problem can be avoided by planning one's film so that the first second of any new shot is silent.[1]

The other disadvantage of single-system editing is having to physically cut the magnetic striped film. Once cut, it is difficult to splice or rejoin smoothly without 'sound bumps' or jolts in the sound track between cuts. As a result, single-system editing requires very meticulous workmanship, especially if the work print is to be the final print. None the less, single-system editing is quicker and cheaper than other approaches. Single-system sound editors cost as little as $160. They are particularly effective and efficient in producing inexpensive materials for television.

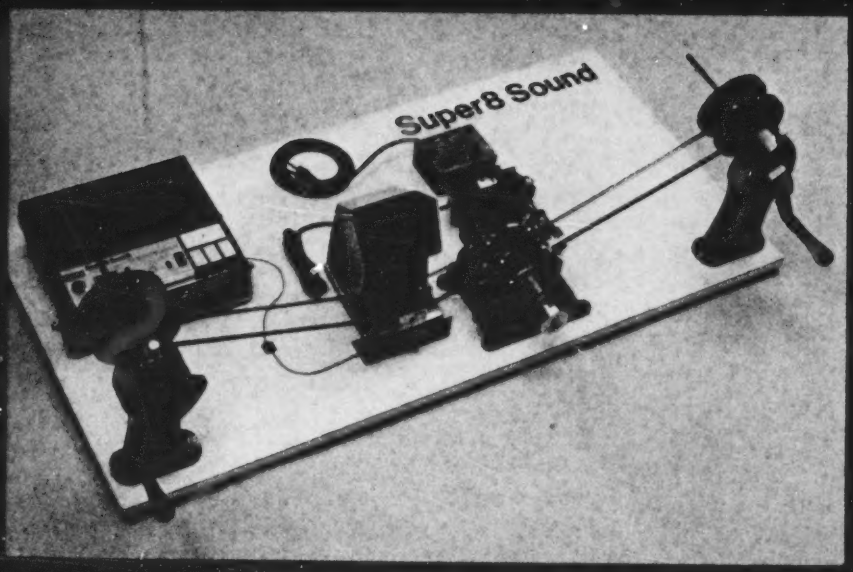
One leading writer on 8-mm film technology feels that the potential of strict single-system sound editing is very underrated. He also feels this method, used in conjunction with double-system fine cutting, cannot

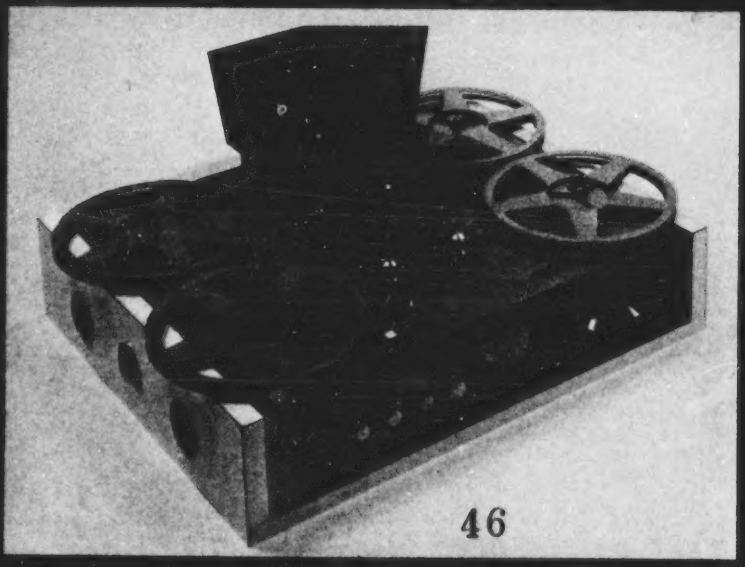
1. Various issues of *Super 8 Filmaker* have contained 'tricks of the trade' which also offer partial solutions to this problem.





Edge-notched synch block for mechanical editing. (above, courtesy of Hollywood Film Co.) and the Uher single-system sound and frame editing set with viewer. (Courtesy of Uher Corporation.)


Super8 Sound



be overrated. To maximize speed, shooting and rough editing should be done single-system. This allows for maximum speed and convenience in shooting and in sifting through large amounts of footage to locate promising shots and scenes. Subsequent fine cutting should be done double-system, so as to permit maximum control of sight and sound.[1] This approach makes even more sense when silent and single-system sound footage are to be mixed into videotape for the final product.

Double-system editing

After sound transfer, the double-system film-maker has separate sound and picture rolls containing equal lengths of super-8 sized film and tape. Sound and picture are exactly synchronized frame for frame. Double-system editing allows the film-maker to line up sound and picture at exactly the same point. This is done by means of the classic mechanical film synchronizer, which consists of two sprocketed wheels, which rotate on the same axis. Sound roll and picture roll are fed on to these two wheels, and are held in place by the sprockets holes on the film and tape. Since the sync marks have been matched up at the beginning of each roll, synchronization is maintained as the film and tape are wound back and forth through the synchronizer. In this way, the double-system film-maker dispenses with the troublesome eighteen-frame lag between sound and picture, and gains a capability to edit sound and picture in precise, frame-for-frame synchronization.

However, more equipment than just the synchronizer (and more expense) is required in order to edit double-system. The film-maker must have a means of viewing the picture and of hearing the sound as they pass through the synchronizer. He must have a means of storing film and tape, and of winding them through the synchronizer, viewer and sound head. Various systems have been devised which accomplish

1. Lenny Lipton, 'Filmcraft', *Super 8 Filmaker*, Vol. 2, No. 3, June 1975.

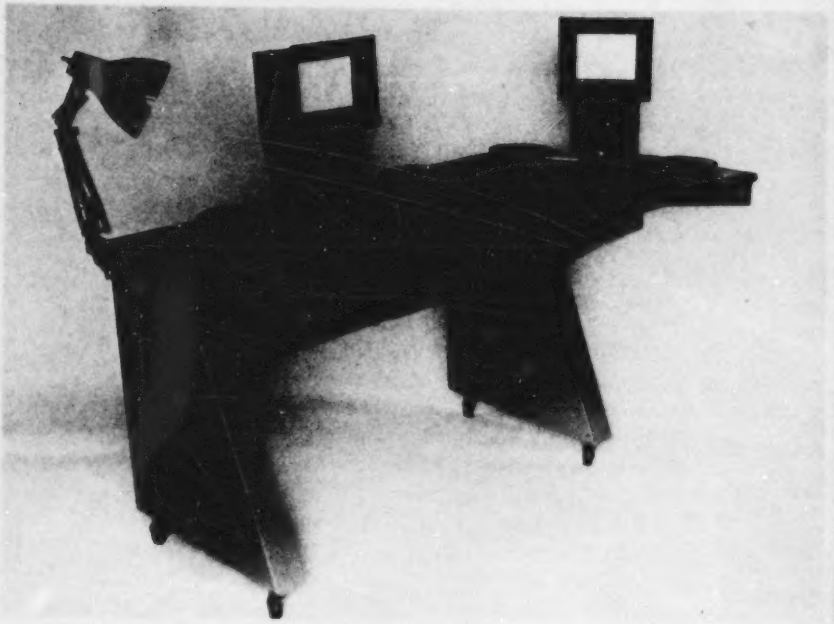
these functions. Complete editing tables for double-system 8-mm film cost between $795 and $4,500.

All the systems offer at least partially motorized transport of film and sound. This is because hand winding does not produce realistic sound. Furthermore, the tedium of manually transporting double-system material distracts serious film-makers from sensing the flow of their films and from performing creative editing functions. The Super-8 Sound editing bench consists of a film viewer, a sound head, and a motorized synchronizer which pulls sound and picture through the machine. Although film rewinding is manual, its design offers realistic sound, and lessens the force required for rewinding. At $795, this unit is widely recognized as an excellent compromise between economy and performance.

Consisting of simple and rugged mechanical components, the unit is particularly suited to non-industrial environments where maintenance and repair of complex equipment is a problem. The only part which might ever be expected to break or wear out is the motor, which can be easily removed and replaced. The synchronizer, sound head and rewinds are simple components, which can be expected to function flawlessly for a lifetime.

The more complex editors may also be of interest to many 8-mm film-makers. The more elaborate hardware uses a horizontal configuration and a completely motorized transport. Film and sound can be run through the horizontal editing tables at exact sound speed, at a slow crawl (for review of specific cuts) or rapid speed (for search of particular shots of scenes). The Super-8 Film Group estimates that horizontal tables can reduce editing time by 50 per cent. Of course, these editing tables cost more than the above unit, and consist of more complex components, which are inevitably somewhat more subject to maintenance and repair problems.

The basic table of this design is the MKM, which accommodates one picture track and one sound track, and which costs approximately $2,000. Informal reports say that the machine is well made, and is



The Super-8 Research ten-plate editing table for three sound tracks and two film tracks, completely motorized. [Courtesy of Super-8 Research Associates.]

well worth the cost. Recently, a small company, Super-8 Research Associates, introduced a more basic table, which will cost about $1,000. However, these simple tables are only the beginning of the trend toward rapid and professionalized editing capabilities for super 8.

Super-8 Research Associates has also developed a table which has two picture tracks and three sound tracks. The table contains electronic circuitry which allows mixing of two tracks (sync sound plus music or narration) into a third master track. The second picture track speeds the location of cutting points from one camera angle to another. This table costs approximately $4,500. Although much more expensive than the Super-8 Sound editing bench, this elaborate machine is much less expensive than corresponding 16-mm equipment. Similar tables by the major 16-mm manufacturers (not all of which, however, offer sound mixing) cost between $8,000 and $12,000.

In Europe, a number of highly improved models have been developed for super 8 for single- or double-system sound editing. Steenbeck (Federal Republic of Germany) already well known for its 16-mm and 35-mm equipment, has manufactured a simple editing table for super 8 (ST1068s). It is a horizontal four-plate table with one 8-mm picture track and one 16-mm fullcoat audio track. All plates are motorized (220 volts 50-60 Hz; 110 volts on request); a rear screen projects the image to be edited. Cost is approximately $5,800. Steenbeck is also developing a six-plate film-editing machine and as soon as sufficient market demand exists, they will also be prepared to install a 8-mm fullcoat audio track instead of the present 16-mm track.

Another German model is the KEM RS-Super editing table with six plates (one super-8 picture track and two super-8 sound tracks). At an ex-works price of $8,700, the table offers screen projection of cuts before editing, motorized tracks, variable forward-reverse speeds from 0 to 100 frames per second, sync speed for all tracks at 24 frames per second.

It is available in 110, 220, 240 volts at 50 or 60 Hz. More expensive models feature interchangeable sound and picture plates and interchangeable film gauges.

What appears to be one of the more advanced designs is the Atema (Sweden) film-editing machine, still in prototype form for super 8. Aside from editing the picture track, the machine can edit sound, transfer sound to magnetic stripe, perform post sync narration, pre-mix and final mix. The entire table weighs 80 kg but can be collapsed compactly for storage or movement.

Although they cost less than the corresponding 16-mm equipment, the more professional editing tables may seem expensive to 8-mm users. Their complexity may inspire fear in those who are far from maintenance and repair stations. None the less, there are two favourable factors, even for some applications in non-industrial countries. The professional editing table is a great time-saver for creative personnel and the time of creative people is always limited. Secondly, many tables use a modular construction, whereby each component can be removed and serviced individually. This facilitates on-site maintenance and return to the factory of the damaged module, rather than the entire machine. Modular construction also facilitates add-on purchases or phased development of equipment.

Splicers

Whether film is reviewed on the simple Super-8 Sound bench, or on the complex Super-8 Research table, it is cut and reassembled by a splicer, a device which is classically simple, reliable and inexpensive. There are two basic ways of splicing film: tape splicing and cement splicing. Tape is the cheaper and safer method, in the sense that editing decisions can be easily changed by removing the splicing tape. At $15, the Guillotine brand tape splicer should be heralded as one of the bargains of film-making. Fuji also offers an excellent and inexpensive tape splicer.

The second alternative is cement splicing, which joins film segments with a chemical bond. Cement splices are stronger than tape, and also more permanent. With cement splicing, it is difficult to reverse editing decisions. On the other hand, a good cement splice goes through the projector more smoothly and cannot separate to create white flashes on the screen as tape splices can. A particularly popular splicer is the Bolex bevel-edged cement splicer. This model produces splices no thicker than the film itself which do not jump in the projector.

The Super-8 Film Group feels that quality cement splices, comparable to 16 mm, can be obtained in 8 mm. However, 8 mm requires more clean and meticulous working procedures than does the larger 16-mm format. For these reasons, film-makers who have trained and grown accustomed to 16 mm find it tedious to edit 8 mm. Those who learn their craft on 8 mm soon learn how to splice the 'modest medium' quickly and cleanly.

Sound mixing

After editing of sync footage, music, sound effects and 'voice-over' narration are often mixed into the sound track. When properly used, these techniques subtly increase the emotional impact of film. They underlie McLuhan's references to the 'media massage' rather than the media message. Only with the introduction of the Super-8 Sound recorder and the four track 'consumer' tape deck did these capabilities come within reach of the modestly financed 8-mm film-maker.[1] Other inexpensive studio sound processing tools, such as microphone mixers and frequency equalizers, can be investigated through sources listed in the appendix on page 87.

1. One fairly expensive sound mixer for super 8 is the Electra Sono Studio, a modified Sony TC-755 table-based tape recorder with sound-mixing panel (about $2,700). A quartz-controlled pilot signal synchronizes sound and image for transfer, mixing and editing of sound. Up to five sound sources can be mixed and synched with either camera or projector signals.

Whether the sync portions of a film are double-system or single-system, relatively tightly controlled sound mixes can be performed with minimal equipment. The better 8-mm sound projectors have recording capability which allows adding music, narration or sound effects to a sync sound track. It is possible to reduce the sound level of the sync recording as the new material is recorded. There is some loss in quality in the original recording. Furthermore, mistakes in sound mixing can destroy the original sync sound. In spite of these drawbacks, single-system sound mixes are performed by many 8-mm film-makers.

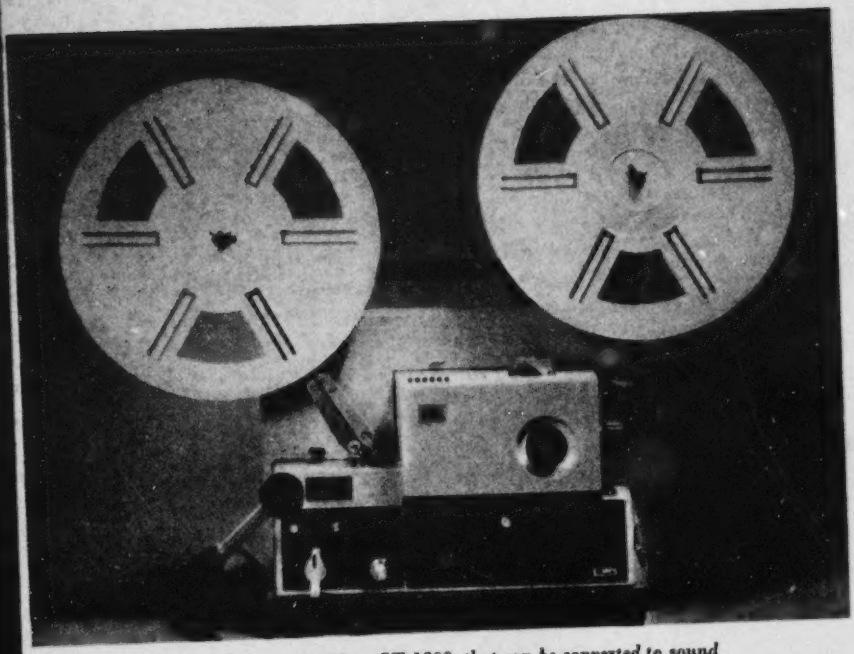
Display

Once edited and sound-mixed, film can be shown by optical projection, by conversion into a television signal, or by transfer to videotape. The method which is chosen will depend upon the film application at hand.

For optical projection, materials which have been shot and edited single-system can simply be played on a sound projector. Double-system materials can be played only on a projector which has been modified to emit sync pulses, which can be read and followed by a fullcoat recorder which has feedback circuitry. During projection, sound can be transferred from fullcoat to the edge of the film, provided the film has been prestriped.[1]

There are two ways to create a television signal from 8-mm film: with a *telecine film chain* or with a *flying spot scanner*. The best known 8-mm television projector is the Kodak TVM100A ($2,000). This projector must be used in conjunction with a telecine

1. There are several machines available for striping camera original super 8. Stripers range in price from $30 to over $400. According to the Super-8 Film Group, expensive stripers such as the Bolex are well worth the money. For technical reasons, film copies cannot be striped by the film-maker. However, sound striping can often be done by the laboratory which prints the copies.



A sound projector, the Elmo ST-1200, that can be converted to sound recording and mixing. [Courtesy of Elmo Corporation.]

film chain in a television studio, in order to convert 8-mm film to television images. On the other hand, the flying spot scanner is an entirely self-contained system, whose signal can be fed directly into a normal television set. Eastman Kodak manufactures one 'videoplayer' for non-broadcast use (VP-I, $1,400) and another model which is technically compatible with broadcast equipment, and which produces a signal of broadcast quality (VPX, $1,300).

Another display option is to record the 8-mm derived television signal on to videotape. In fact, Eastman Kodak spokesmen report that the videoplayer has been used primarily for transferring 8-mm film to videotape rather than for direct display of materials. Video display is most commonly achieved by use of a ½-inch Philips or ¾-inch Sony standard videocassette recorder. These machines generally cost between $1,200 and $2,000. They have the advantage of being far simpler to operate than the open-reel movie projector.

A final display option, which rivals the videocassette player in its ease of utilization is the 8-mm cartridge projector. Unlike open-reel projectors, cartridge projectors do not require threading. The cartridge is simply shoved into the machine and the volume is adjusted. However, this option does require the packaging of the film in a special cartridge. Many of these projectors cannot function with an original edited film, because the splices will not pass smoothly through the mechanism. As a result, cartridge projectors are usually employed with film copies.

Distribution

There are several alternatives for distribution of 8-mm film materials: cartridge prints, reel prints, television broadcast of originals, and videocassette copies. The cost and practicality of these options vary widely. Users of 16 mm and 35 mm are justified in criticizing the lack of standardization in most

8-mm distribution formats. On the other hand, this situation can also be seen as an advantage, offering the 8-mm producer a variety of options.

The 8-mm cartridge

Many large institutional users of super 8 are devoted to the cartridge projector. Cartridges offer convenience and fool-proof operation. Many cartridge projectors are light, fold into a small briefcase, and cost $150–$500. These models contain built-in rear projection screens for daylight viewing by small groups. Many can also do long-throw projection for use in darkened rooms with larger groups. However, there are two reasons why these tools cannot receive complete acclaim for use by 8-mm producers.

The first reason is the difficulty of producing materials for these projectors on 8-mm film. As ironical as it may seem, most films distributed in this manner are produced on 16 mm and reduced to 8 mm in printing by specialized laboratories. While this solves a number of print quality problems that plague 8 mm, it is not encouraging to people who want to use 8 mm as the production medium.

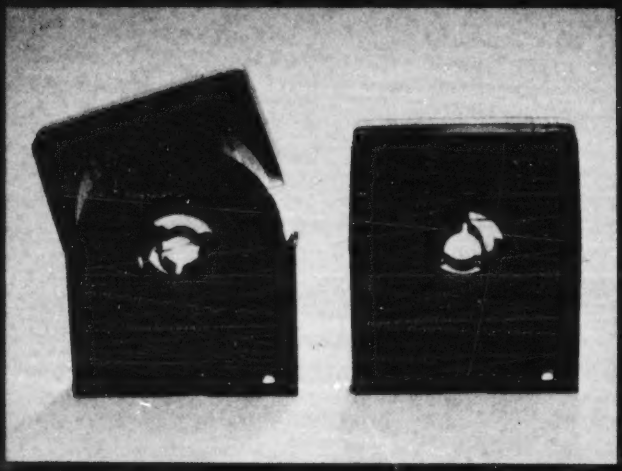
There is a second drawback to the cartridge projector: the lack of standardization between equipment manufacturers. In a brief investigation, seven mutually incompatible cartridges were uncovered.[1] Some use magnetic sound tracks. Some use optical sound tracks, which are photographically printed on to the edge of the film. Others use two cartridges; one for pictures, one for sound. This final approach deserves special mention.

Three different manufacturers are developing two-cartridge systems. Each of the three systems (called PIP, Cue/See and I-9 by their makers) uses a standard ⅛-inch audiocassette for the sound track. Unfortunately, however, the cartridge which contains

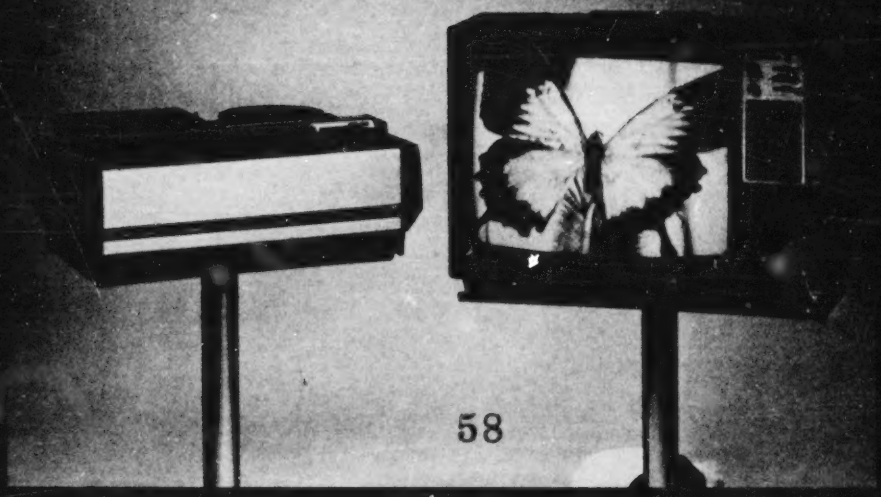
1. The seven manufacturers are: Fairchild, Technicolor, Kodak, MPO Videotronic, Bohn and Benton, Beseler, and Philips. In addition, there are more manufacturers of lesser known special application cartridges.

The Beseler Cue-See system using separate sound and film cassettes [Courtesy of Charles Beseler Co.]

The PTP system utilized for automated self-learning. [Courtesy of Philips Corporation.]



The Kodak Supermatic 400 outfit, Cabaret and the Kodak Supermatic 400 outfit, Debutante. Courtesy of Eastman Kodak Co.



the 8-mm visual track is different in each case. Also, the method of regulating speed of the visual medium by inaudible one-per-frame pulses on the audio track is technically different with each system. As a result, software produced on one system cannot be played on either of the other two systems.

Nevertheless, if one commits to a specific system and uses it in a major application, the benefits deriving from split audio and visual tracks are impressive. The audio track always moves at constant sound speed. However, the visual track moves only when it is necessary to depict motion. Slow movements can be filmed and projected at six or nine frames per second. Still pictures, graphs and charts use only one frame of film, no matter how long they are to remain on the screen. Conventional motion-picture speeds are used only when lip movements or rapid motion must be shown.

This capability of varying the speed of the visual medium results in savings on film and processing. A 20-minute programme is likely to use only 50 feet of film, which would last only 3 minutes at conventional filming speed. Cost savings can be significant when large numbers of film copies are produced. However, capital costs of these systems are somewhat higher than conventional film systems. Furthermore, quality printing and cartridge loading may be difficult to obtain in many locations.

8-mm open-reel prints

The second major distribution alternative for 8-mm film is via film print on open reels. When problems of cartridge incompatibility are dispensed with, 8-mm printing problems loom even larger. As mentioned above, laboratory services in 8 mm leave much to be desired, even in the film-production centres of the industrialized countries. Only a few laboratories in the world offer 8-mm film-makers the services which are standard in 16 mm. At this point two problems deserve further elaboration: low print quality and inadequate edge-numbering services.

Films are either positive reversal films, which process to a positive print, or negative films, which after processing must be printed on to a positive film in order to be viewed. In summary, film prints can be made in three ways, as listed below in order of ascending print quality: (a) positive reversal film to positive print; (b) positive reversal film to internegative to positive print; (c) negative film to positive print. The third method is the one which is most generally employed in 16 mm. This also offers matched pairs of camera and print films, which are designed to allow for the inevitable *contrast build-up* which results when a film print is made from an original.

Since 8 mm is still primarily used by amateurs, who do not print film copies, all 8-mm film is positive reversal film, which processes to a realistic image with *projection contrast*. When prints are made, they must be made by one of the first two methods mentioned above, and they inevitably involve some build-up in contrast beyond the normal projection contrast of the original and towards exaggerated colours where middle tones and detail are lost. The degree of quality loss from original to print depends upon the laboratory making the print, the film type employed, and—most importantly—the quality of exposure and processing in the original film. Most film-makers in both the industrialized and the non-industrialized countries lack access to laboratories which have made the large capital investment in equipment that is necessary in order to offer the sophistication and control in printing available to the 16-mm film-maker.

In order to minimize loss in quality during printing, 8-mm film-makers must exercise extreme control over the quality of their original film. Exposure and focus merit special attention. Scenes can be illuminated with artificial lights and reflectors so as to minimize contrast in the original film. When the original is printed contrast builds up to a realistic, projection contrast level.

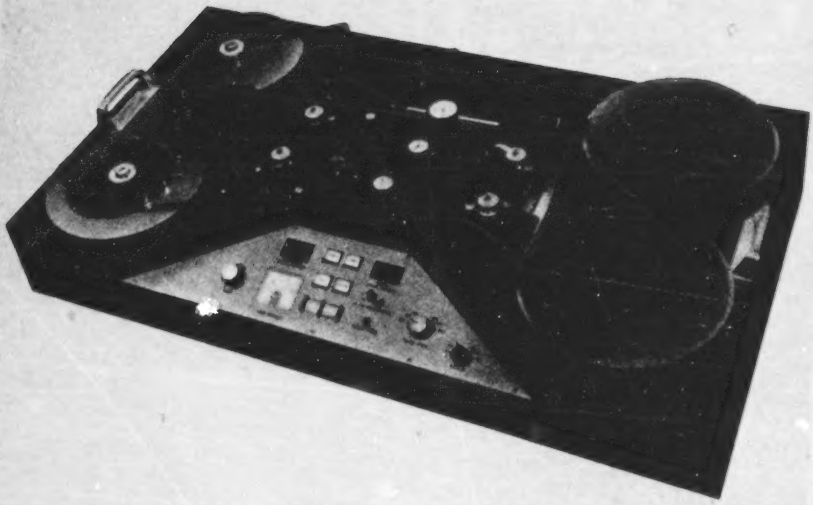
Other solutions are simply to accept the lowered quality of 8-mm prints as one limitation imposed by the ease and economy of the medium. Although

contrast build-up can be avoided, considerable expertise and expense is required, which dilutes the innate features of the 'modest medium'. Many film-makers simply edit their camera original film, and copy by transfer to videotape. This approach avoids the colour quality loss and the expense of film prints.

Another point which militates in favour of editing 8-mm original is the unavailability of *workprinting*. 16-mm users generally edit workprints rather than risk scratching their originals. The originals are only cut and prepared for printing when the workprint has been edited and re-edited to the film-maker's satisfaction. When the 16-mm film-maker is ready to match up or *conform* the original to the edited workprint, the process is speeded by edge-numbers, which are present at the edge of the original, and which have been printed on to the workprint.

In 8 mm, workprinting can cost almost the same amount as the original processing. Edge-numbering in 8 mm is rarely available, and often poor in quality. Since numbers are not present in the 8-mm original film emulsion, they must be stamped on to the edge of original and workprint. In this process, ink can spill from the edge of the film and on to the image area itself. When edge-numbering is not available, 8-mm film-makers who edit a workprint are left with the tedious and time-consuming job of conforming visually 8-mm unedited original to a miniscule 8-mm workprint. It is all the more critical when editing animation films which demand edge-numbering for precision.

As a result of the above considerations, many 8-mm film-makers edit their original camera films as standard procedure. This requires clean and careful working habits. However, the risk of damaging, scratching, or miscutting an original must be weighed against the additional time and expense of workprinting and conforming an original to a workprint. Working with the camera original means that the cinematographer will have to give up laboratory-processed fades and dissolves, but with the right equipment he can always provide for these during shooting.



The Acme mini-printer makes copies of 8-mm materials and can produce optical sound. [Courtesy of PSC Technology, Incorporated.]

In-house printing

The decision to edit one's camera original reduces dependence upon laboratory services. It is now possible to consider dispensing with such dependence altogether. Recently, a printing machine has been developed which would allow the small 8-mm production unit to produce its own print copies. However, this printer has not been used widely for production printing. Its application would have to be approached on a purely experimental basis.

The Uhler cine printer is an inexpensive ($500) contact printer, which can produce black-and-white prints at a rate of 40 feet per minute. Allowing for loading time, this machine should be able to produce sixty copies of a half-hour film during an 18-hour day.

In addition to pure reproduction printing, the Acme optical printer offers a host of features for production of special optical effects. The machine can 'freeze frames' from motion footage, fade to black, produce dissolves, and perform density and colour correction. Drawbacks of the Acme printer are its cost ($12,000), its slower printing speed, and the great skill required for optical printing.

In order to use either of these machines as the basis for a self-contained printing laboratory, measures will have be developed for processing large amounts of film. In addition, the entire printing-processing system must be devised and tested under real work conditions, before any firm conclusions can be drawn. Perhaps this new prospect of total independence from outside technical services will spur into action those film-makers who are most remote from commercial laboratories.

8 mm and television broadcast

One way of entirely avoiding the time, complexity and expense of 8-mm printing is to distribute 8-mm films by television broadcast. Of course, this distribution system presumes access to television receivers by

the audience, as well as access by the 8-mm producer to a television station. This method has the further limitation that audiences cannot schedule their viewing at their convenience or view a film for a second time, as they can when they have their own 8-mm copies.

None the less, distribution by television is inexpensive and instantaneous. Whether a telecine film chain or a flying-spot scanner is used, image quality can be improved during transmission by electronic image manipulation. 8-mm proponents maintain that, when image enhancement is properly done, 8-mm film and 16-mm film are almost indistinguishable on the home television screen.

In countries where television is still a developing medium in search of new programme resources, 8 mm has much to offer by way of providing economically and quickly various types of materials taken from the local scene, even mixing these with graphics and live camera.

Videocassette

The simplest way of producing cassette copies of 8-mm materials is to patch a videoplayer into a cassette recorder. Since recording takes place at playback speed, one could produce almost thirty-six copies of a half-hour film in an 18-hour period. The cost of the components would be under $3,000. Although this is a good deal cheaper than the Acme film printer, the equipment required to play back a cassette ($1,500) is over six times the cost of a sound film projector with accessories.

However, videocassette transfer of 8-mm materials has the advantage of allowing titling, optical and sound effects during the transfer. Kodak recommends the use of two videoplayers in conjunction with an electronic special effects generator. The product is recorded on to a videocassette recorder and copied by re-recording on to another cassette machine.[1]

1. 'Super 8 Film in Television', *Videofilm Notes*, p. 10, Rochester, N.Y., Eastman Kodak Co., 1974. (Publication No. H-40-7.)

Conclusion

This rapid tour through the realm of current 8-mm equipment demonstrates the versatility of the medium. Figure 2 shows graphically the various production options. But if the 8-mm revolution seems incomplete, that impression is certainly correct. Even as this survey was going to press, several new items of equipment were being released in experimental or prototype form. Standardization has not yet been achieved in film cartridges or compatible sound equipment. Film manufacturers still have to develop finer emulsions, an improved negative/positive system, and a more reliable and more widely marketed 8-mm fullcoat tape. It is expected that when a larger market for higher quality super 8 products exists, manufacturers will respond with increased standardization and improved products.

This leads to a word of caution on the economy of super 8. At the simpler levels of production (one camera, shoot-edit type filming, single-copy positive for both workprint and release print, single system unedited sound) it can be generally agreed that super 8 is an extremely economical medium. When this simple level of production is all that is needed to feed supplementary materials for a live or taped television programme, again super 8 is very economical.

But the moment the film-maker demands a higher level of production and quality (silent and sound cameras, double system sound, synchronized sound and picture editing, negative shooting, positive workprint, and positive release prints), super 8 then approaches the methodology and costs of professional 16-mm film production. If all other costs of production are the same no matter what the medium, but equipment and raw costs comprise a major part of the production budget, then considerable economy can be made in 8 mm. And the simpler the production, the greater the economy.

The option for super 8 is not a simple matter. It will depend on a number of interrelated factors:

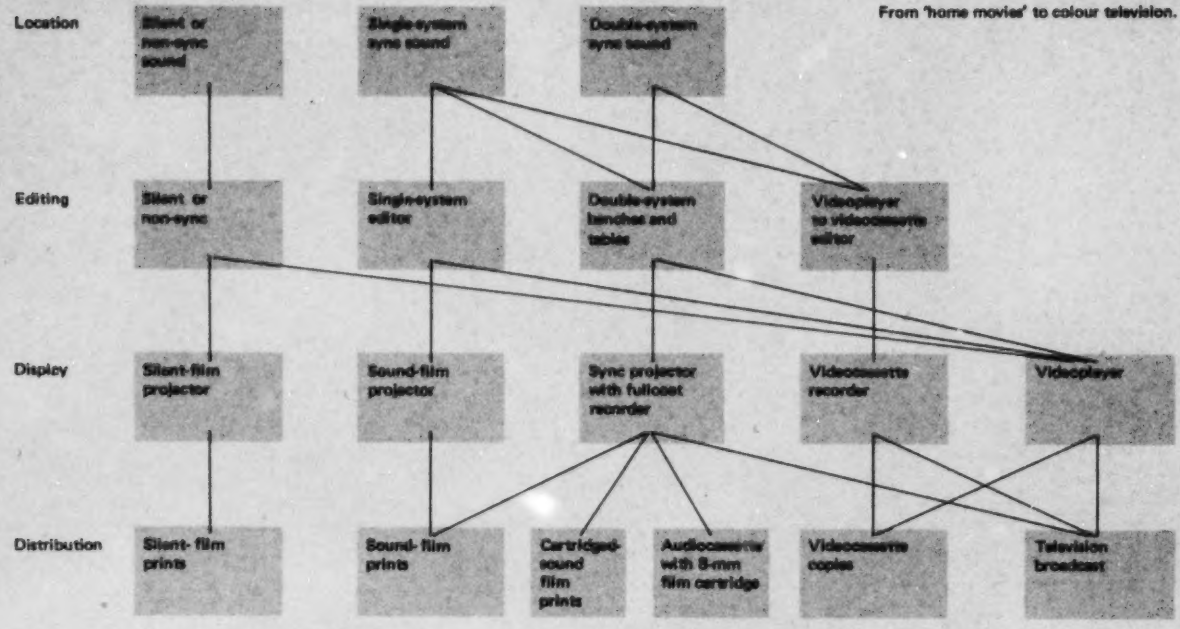


FIG. 2. *Summary of 8-mm production alternatives.*

the uses and purpose of the film, the simplicity or complexity of the production, the level of professional quality that is required, and of course the available budget. If the increased costs of professional production seem inhibiting, this is balanced by the lower costs of simpler production which provide access to a film medium where otherwise there may have been none at all.

Chapter III

8 mm in relation to other media

Ever since the introduction of 35-mm film in the last century, new audio-visual technologies have been evolving and defining their role in world communication. Whereas 16 mm was initially rejected by professional film-makers, it has now become the most universally accepted of the professional production media for television. The newer electronic technology of videotape, though plagued by the incompatibility of several competing technical standards, is undergoing constant refinement, miniaturization, and improvement in colour to become a hot competitor of small-gauge film. Meanwhile, the 16-mm film-maker stands aloof from both the newer media, confident that his medium will reign supreme forever. A reasoned appraisal of the three media demands that one go beyond grand generalizations toward consideration of the strengths and weaknesses of each medium in relation to a number of situations.

The versatility of 8 mm

There are many varying levels of funding and sophistication with which 8 mm can be used. The equipment necessary to gain entry to the medium could be as modest as the following: two M-22 cameras, $60; two audiocassette recorders, $80; one silent projector, $100; one silent editor, $100; one splicer with tape, $25; developing tank and chemicals, $100—giving a total expenditure of $465 for a basic 8-mm production kit. This would allow in-house development of black-and-white film and editing of film. Non-sync sound could be recorded, and edited (by re-recording on to the second cassette recorder).

A larger investment would allow for duplication of all fragile components in the system, sync sound, mixing of wild sound with sync sound, and production of titles superimposed over a live action background.

The selection and cost of an intermediate 8-mm sound production kit could be as follows: two single-system sound cameras, $450; two quality microphones, $80; ten cheap silent cameras, $300; six cassette sound recorders, $300; one Elmo 'Titlist' camera, $300; one single-system editor, $200; two splicers (tape and cement), $70; two recording sound projectors, $1,000; one film processing tank, $100; still camera equipment, $200; miscellaneous, $200—giving a total expenditure of $3,200 for the kit. This amounts to two sync sound units, five non-sync sound units, and five silent units. In addition, the system has editing and sound mixing capabilities. The only costs not covered by the hardware budget are those of film, batteries, developing chemicals and audiocassettes.

A full-blown 8-mm production system with a capability of distributing copies via broadcast television or videocassette would entail an investment such as that contained in Table 2.

While $52,325 seems like a great deal of money in the context of 8-mm film, this amount represents

TABLE 2. A complete 8-mm production system (in dollars)

Equipment	Price
Location equipment	
1 Beaulieu 5008-S sound camera with zoom and macro features	1,600
2 Kodak professional XL sound cameras at $425	850
2 Nizo 801 cameras with dissolve capacity and intervalometers at $809	1,600
4 Eumig mini-5 cameras with zoom lens at $300	1,200
1 Elmo 'Titlist' camera with macro and titling capability	500
3 Super-8 Sound Scipio cassette sync recorders at $150	450
2 Super-8 Sound Scipio cassette crystal sync recorders at $200	400
2 Super-8 Sound crystal camera control boxes at $250	500
2 Super-8 Sound XSD cassette crystal sync recorders at $500	1,000
2 Kodak basic sound cameras at $150	300
10 Kodak basic silent cameras at $30	300
TOTAL	8,700
Film processing equipment	
Kodak automated processor with accessories	15,000
Sound processing equipment	
1 Super-8 Sound resolver	200
2 Super-8 Sound fullcoat recorders for sound	1,290
1 Teac 3340 Simul-sync recorder for sound mixing	1,200
1 BSR Metrotec FEW-2 equalizer for sound mixing	200
1 Sony microphone mixer for sound mixing	300
TOTAL	3,190
Editing equipment	
5 simple single-system editors at $250	1,250
2 Super-8 Sound single/double-system motorized editing benches at $895	1,790
1 MKM horizontal, fully motorized editing table	2,000
1 SERA-PCP 45 eight plate editing table	4,495
TOTAL	9,535
Projection equipment	
2 Bolex SM 8 sound projectors with recording and mixing functions at $600	1,200
3 Kodak VPX videoplayers at $1,300	3,900
1 special effects generator at $2,500	2,500
1 videocassette recorder with accessories	2,500
1 television monitor	800
TOTAL	10,900
Miscellaneous	
Lights, tripods, camera silencers	2,500
Spare parts, cables, connectors, etc.	2,500
TOTAL	5,000
GRAND TOTAL	52,325

only two studio television cameras of the type used by the El Salvador educational television reform. For this amount, an 8-mm film project receives twelve simple location units for trainees, five intermediate units, and five top-quality units. Film processing is done in-house, as are all sound transfers and mixing functions. There are five simple editors, two semi-motorized single/double-system editing benches, and two fully motorized editing tables. If copies of programming are needed, they can be made on ¾-inch videocassette.

Virtually all the technical functions of film-making are handled without any dependence upon outside technical services. This would be impossible in 16-mm film. A total of twenty-two location units and nine editing units are included. These capabilities are achieved for an expense equivalent to three top 16-mm cameras.

8-mm v. 16-mm film

Several of the benefits of 16-mm film have been mentioned above. 16-mm image quality is acceptable either for direct projection, in conjunction with videotape, or for direct television transmission. 16-mm film is a thoroughly professionalized medium in wide use, offering the film-maker a broad selection of quality equipment, of film types, and of technical services.

However, 16-mm film is a correspondingly more expensive medium than 8 mm. The least expensive camera is a spring driven Bell and Howell without a zoom lens, which costs about $500. For the same money, one can purchase an 8-mm camera with a motor drive, an automatic exposure system and a motorized zoom lens. The most expensive 16-mm cameras cost almost $15,000. Just the film magazine for the Arri BL costs more than a high-quality, 8-mm camera.

In like manner, other types of equipment for 16 mm cost several times their equivalent in 8 mm.

Virtually all professional sync tape recorders in 16 mm cost over $1,000. In 8 mm, the simplest tape recorders are available for under $150. A horizontal editing table in 16 mm generally costs over $8,000. Such tables for super 8 can cost as low as $2,000. Sound-mixing equipment for double-system 8 mm costs under $3,000. In 16 mm this equipment is so expensive that virtually no individual 16-mm users own their own equipment. Sound mixing in 16 mm is done by professional sound studios which can charge over $120 per hour for their services. The lower cost of 8-mm equipment enables the 8-mm user to own his own equipment and to escape from expensive rentals and technical services.

Running film through the 16-mm camera is a good deal more expensive than 8 mm. While an image area three times that of super 8 yields greater image quality, it also results in much higher bills as shown in Table 3.

Of course, for the added cost of 16-mm production, the film-maker gets: (a) access to the finer professional film emulsions; (b) a negative/positive film system; (c) frame-for-frame synchronized double-system sound; (d) a variety of picture and sound editing/mixing tables; and (e) high-quality positive prints. Synchronized sound and professional editing/mixing tables are available in 8-mm, but at a cost that approximates that of 16 mm. But film emulsions, negative/positive system, and multiple prints rivalling the quality of 16 mm have not yet been developed for 8 mm. The 16-mm camera and sound accessories are also available in relatively compact form, not always as light and versatile as its 8-mm counterpart, but portable none the less and usually quite rugged.

TABLE 3. Costs of 10 minutes of filming (in dollars)

	Film	Processing	Workprint	Total
16 mm	44	32	44	120
Super 8	16.80	12	22	50.80
Double super 8	11	12.25	15.25	38.50

When planning for simple productions, shoot/edit type sequences, silent footage (as supplementary television materials or for live narration) simple demonstration clips, films with music or sound effects but no lip-synch (synchronization of voice with mouth movements), or use of camera originals only (no workprint, no copies), then 8 mm provides the most economical and simplest access to a film medium. When the purpose of the film demands finer film emulsion, multiple prints, tightly synchronized sound editing, various optical effects produced during laboratory processing —in brief, professional film methodology—then the film-maker must either accept the higher costs of professional 8-mm film production, or even opt for the still higher costs of 16 mm.

The figures in Table 3 show that shooting 16 mm costs almost 2.5 times as much as shooting super 8, and over three times as much as double super 8. These savings become especially important in *vérité* filming, where shooting ratios are high, since one cannot control when interesting events will occur before the camera. Since actors are not hired and scripts are not written, film costs are a major item in a *vérité* film budget. As a result, 8 mm is ideally suited to this type of film-making.

On the other hand, the lower equipment and materials costs of 8 mm become less important in tightly scripted films which use professional actors and large crews. In the budget of such a film, equipment and materials costs are relatively small items. The over-all cost of the project is not greatly affected by the added costs of 16 mm. In addition, the added costs of 16 mm are justified by technical quality required to match the scale of the production. In the words of Robert Doyle, president of Super-8 Sound, 8 mm makes most sense when the people on both ends of the camera are working for love of their craft rather than for money.

Indeed, there are some instances when 8 mm can prove more expensive than 16 mm. If one needs to distribute a 16-mm product, it may prove cheaper to shoot the original on 16 mm rather than to enlarge

an 8-mm film to 16 mm. Although quality blow-ups are available, they are expensive. It would cost from $1,500 to $2,400 to enlarge a half-hour film to 16 mm. This expense might well cancel any savings which had been realized by producing on 8 mm. Furthermore, a film transferred from 8 mm to 16 mm will inevitably be of lower technical quality than a film produced completely on 16 mm.

In addition, films produced and distributed on 8 mm can approach the costs of 16 mm, if many professional technical services such as optical and sound effects are handled by outside laboratories. Only when technical functions are performed by the 8-mm film-maker himself, do costs remain low.

8-mm film *v.* video

The other medium which is often proposed in lieu of 8 mm is small-format videotape. While this technology cannot be explored in depth in this context, some comments are in order on the question of 8 mm *v.* video. Another approach, 8 mm plus video, will also be mentioned.

Videotape is a newer, more complex technology than film. Videotape was invented less than twenty years ago, and derived from the electronic technologies of audio recording and television. The first portable, small-format videotape recorder did not appear until 1968. The first *portapak* (portable videotape recorder and camera) with colour capabilities appeared within the last three years.

The portapak has progressed a long way since its introduction seven years ago. Unlike the initial units, the current black-and-white models provide reliable service and acceptable images, if they are carefully maintained. Regarding the colour portapaks, there have been favourable informal reports. However, one must keep in mind the newness and complexity, and rapid development, of this technology.

The basic Sony portapak costs in the area of $1,850. The recorder and camera weigh about 22 lb.

They produce black-and-white images on 30-minute reels of ½-inch videotape, which cost about $20. The rechargeable battery pack powers the unit for 20 minutes. Sound is synchronous with picture, since it is recorded single-system at the edge of the tape. The image can be played back on the unit's recorder through any television set. Processing of visual images and transfer of sound are eliminated in electronic recording. Materials can be played back immediately after recording. Videotape is cheaper than film. Unlike film, used videotape can be erased and re-used.

One television documentary, televised nationally in the United States, was edited down from 90 hours of ½-inch videotape (see Table 4). The cost of producing such a programme on any film format would have been astronomical.

Of course, a shooting ratio of ninety to one is highly unusual. Many people maintain that the low cost of video encourages unnecessary shooting. Nevertheless, the lowered cost of shooting video is impressive, and does make possible new types of spontaneous audio-visual communications.

In order to attain these lower materials costs, the video producer must invest much more in hardware than the 8-mm user. In addition to the camera/recorder unit, editing equipment must be purchased as well. The minimum cost of a sample ½-inch videotape production system (black and white) would be as follows: one Sony 3400 portapack, $1,850; two Panasonic 3130 editing decks at $1,800 each, $3,600; two Sony 12-inch monitors at $300 each, $600; miscellaneous (cables, power supplies, microphones, lights,

TABLE 4. Film and processing costs for ninety hours of shooting (in dollars)

	With full workprinting	With no workprinting
16-mm film	64,800	41,040
Super-8 film	27,432	15,552
Double super-8 film	20,790	12,555
½-inch videotape	3,600	3,600

equipment modifications), $500; giving a total of $6,550 for a basic ½-inch videotape production kit. In order to produce such effects as titles, dissolves, and superimpositions, additional equipment would be needed.

In order to broadcast ½-inch videotape over television, a *time-base corrector* (TBC) is required. This machine, first introduced in 1973, eliminates the small timing errors of small-format videotape, which previously prevented it from attaining broadcast quality. One of these machines costs about $14,000. Although television stations in industrialized countries are beginning to purchase this equipment, video applications in non-industrialized countries might well have to add the cost of a time-base corrector to their hardware budget.

Under this assumption, a project using video in a non-industrialized country would need $20,000 worth of hardware in order to gain access to television broadcast. For 8 mm to use television, the hardware mentioned in the simplest application above would need merely an additional investment of $1,300 in a Kodak VPX videoplayer, whose signal does not require time-base correction before broadcast. For the moment, only sixty-cycle versions of the VPX are available. Nordmende of the Federal Republic of Germany has shown a prototype flying spot scanner which operates on fifty-cycle current. Thus the hardware cost of gaining access to television with 8 mm would total under $2,000.

A video system which produces quality colour videotape would require an investment such as the following: Sony 1600 colour camera, $5,000; Sony 3800 portable cassette video recorder, $3,000; Sony 2550 editing programmer, $1,000; two Sony 2850 editing decks at $6,000 each, $12,000; two Sony 17-inch television monitors at $950 each, $1,900; miscellaneous (cables, microphones, lights, tripods), $2,000; giving a total of $24,900 for a basic colour videotape production kit. This system contains an advanced programmable editing system, which increases quality and speed of editing over that

offered by the less automated systems such as the black and white system mentioned above.[1] It is also easier and quicker to edit on than the simple mechanical tables of the $2,000 8-mm system. Of course, automation also has a major drawback. As a state-of-the-art system, it is more complex, more fragile, and certainly more subject to breakdown than the relatively simple mechanical editing systems of 8-mm film.

None the less, 8-mm film users who have the necessary capital, the access to repair facilities and the need for rapid editing can think in terms of combining their technology with video. 8-mm materials can be played back on a videoplayer, and recorded on a videocassette recorder. Then they can be edited on the Sony programmed editing system. The final product can be distributed by television broadcast or by videocassette copy.

If cost is a major factor, 8 mm has an edge over video recording in the generation of television and videotape materials. A single-system 8-mm camera plus a videoplayer costs between $1,600 and $3,000, depending upon the camera quality. This is a far cheaper system for generating colour television signals than either the Akai colour portapak ($6,000) or the Sony camera and portable recorder ($8,000). It is also much lighter and more rugged than video-recording equipment.

Video recording, on the other hand, has some distinct advantages over film, As detailed above, tape costs a small fraction of the cost of film. Tape does not require the expense and delay of processing. Video production is instantaneous, and offers immediate playback. Video images have a live presence to them, which film does not have. Continuous technical progress in electronics is improving video equipment, and reducing its cost.

1. Two points should be noted about this editing system. It does not have the capability to produce dissolves, titles or supers. An additional $5,000 worth of equipment is required for this. Secondly, prices on sophisticated programmed editors are expected to drop as other manufacturers introduce models to compete with the Sony system.

Fortunately, it is possible to have the best of both worlds, especially if television broadcast or videocassette is the distribution format. Under these conditions, and in view of the current ease of transferring 8 mm to television signals, it is possible to generate original materials in either 8 mm or video, according to the demands of the specific situation. A *vérité* situation that demands an extremely high shooting ratio, where electrical current is available, would call for video origination. A location without electricity, where portability was a consideration, or where equipment might be damaged or lost would encourage the use of 8 mm.

From shooting, the integration of 8 mm and video extends into editing and sound mixing. Producers working on small budgets can edit 8-mm materials entirely on film, and transfer the final product to tape, at which time video material can be edited in. Producers with larger budgets may choose to transfer 8-mm materials direct to tape, and then edit both 8 mm and video materials entirely on videotape. The trend seems definitely away from confrontation between the two media and towards a synthesis whereby preproduction materials from various media —16 mm, single- and double-system 8 mm, videotape of different formats, effects on audiocassette, plus inputs from live television cameras, graphics or slides—are mixed electronically into a final videotape product.

One would hope that producers will come to see themselves not as film-makers or television producers, but as image makers who mix a range of technologies according to the demands of each specific situation in which they operate.

Conclusion

In the light of the previous chapters, we can now summarize the qualities of 8-mm film and put them in the balance of planning decisions for media applications.

8 mm is economical. Adequate equipment in black and white or in colour, with or without in-house processing, can be obtained at less than half the cost of equivalent 16-mm equipment. Lower costs for film also mean higher film ratios and consequently more varied editing decisions.

8 mm is versatile. Lightweight, miniaturized equipment means greater portability and movement into 'high-risk' areas at sea, perilous mountain crags, etc., where professionals would think twice before lugging in a 16-mm or 35-mm camera. 8-mm versatility permits shooting under almost any condition. Its essence is spontaneity and participation.

8 mm is easy to operate. Simplicity of operation allows larger groups of people to gain access to production materials without lengthy, technical training. It also gives more time for the creative

people to express their genius on production artistry instead of mere technicalities.

8 mm is flexible. Due to the variety of equipment options, 8-mm equipment can be used solely for film or in conjunction with television and other video materials. As a strictly film medium, there are numerous ways of combining sound and image.

8 mm is basically a production medium, not a distribution medium. The many new features incorporated into today's 8-mm cameras (low light capability, built in light meters, manual or electric zooms, automated fades and dissolves, stop-frame shooting, and the like) have generated basically a production system. Because of this, most editing decisions have to be made or at least foreseen at the time of shooting.

Double-system editing, sound transfer, and sound mix can be performed with 8-mm equipment at reasonable cost, but the more precision and quality equipment are needed, the higher the costs rise.

Moreover, since most 8-mm film is available only in positive reversal form, the 8-mm system is mainly for shoot/edit and show. As of this writing, laboratory processing for 8 mm has not yet reached the sophistication of 16 mm and 35 mm with controlled-contrast prints. And indeed the world-wide demand for such prints has not made improved laboratory processing commercially viable. Extra prints, however, can be made, and with tolerable contrast, as long as the film-maker foresees this and prepares for it by proper lighting and shoot/edit decisions. The improved features of 8-mm cameras not only provide for these shoot/edit decisions, they also compensate somewhat for the restricted laboratory possibilities.

Taking these basic qualities into consideration, communication planners will have to study whether their problems can be solved by a medium that is economical, versatile, simple to operate, flexible, but with limitations in making extra copies. They will also have to decide if their situation can accept the slightly lower image quality for other advantages, like portability and economy.

In the developing countries, the possible uses of 8 mm are numerous, most of them not fully exploited. An 8-mm project can provide film training economically for universities or training centres concentrating on film or film-to-television production for education or culture. 8 mm can provide quick, low-cost programme inputs for existing television stations. 8 mm can be taken to the bush or the isolated farms for on-the-spot reportage or *cinéma vérité* essays. 8 mm can reflect the depth and variety of a culture to its own people, even using separate sound tracks on cassette for the many dialects spoken. As a matter of fact, the more 8-mm cinematographers keep away from the 'established practices' of filming in the industrialized countries, the more they can create new possibilities and applications of the medium.

In the long run, it must be recognized that the 8-mm revolution is not finished. It has just begun. The new directions 8 mm will yet take will in great part be determined by its usage in the next few years. Greater demand for further professionalization of equipment and film, as well as more sophisticated laboratory processing, will eventually inspire manufacturers to respond with improved yet simplified hardware. The tentative nature of much of this report is due to the fact that this revolution is still going on, that equipment is still being improved and even invented.

Like the box camera of old or today's pocket 110 automatic camera, 8 mm is a medium that began in the hands of the amateur. Its language is simplicity, its manner spontaneous, its usage as creative as its user. In the Third World especially, the possible innovations with 8 mm are considerable. And very likely it is in the Third World that the 8-mm revolution will have its greatest impact.

Appendix

Access to further information

Obtaining accurate and current information on 8-mm film technology requires active information seeking. Since work on this study was begun, two major pieces of 8-mm equipment have appeared, which affect the potential of the medium (the Acme optical printer, and the Kodak VPX broadcast video-player). In any field which is developing so rapidly, books cannot be relied upon. Most of the information in this study is derived from catalogues, magazines and conversations with people active in the development of the medium. This last type of information is crucial in order to counter the exaggeration often found in manufacturers' catalogues, and in the magazines in which manufacturers advertise.

In the list of information sources below an attempt has been made to supply all the information needed for readers to gain access to the source listed. In addition to the city of publication and publisher, the 'access bibliography' below also includes the publisher's address and the price of the book. In order to speed service, payment should be made in advance by international money order.

By the time these words are in print, two excellent books on 8 mm will have been published. Their in-depth 'how-to-do-it' coverage of 8 mm should complement nicely the 'what-can-be-done' orientation of the present study:

HOOS, Gunther; MIKOLAS, Mark. *Handbook of super 8 production.* United Business Publications, 750 Third Ave., New York, NY 10017, 1975. $13.50.

These two film-makers have been working professionally in 8 mm for over five years. They own the only production company in New York which is dedicated exclusively to 8 mm. Their book will cover the entire range of 8-mm alternatives, from the simplest to the most professional. Their knowledge of nuts-and-bolts technical aspects of 8-mm film-making should be used before committing oneself to the medium.

LIPTON, Lenny. *The super 8 book*, Straight Arrow Press (625 Third St, San Francisco, CA 94107. $6.95), 1975.

The author of what is generally considered the best American text on independent film-making has turned his interest to 8 mm. Some years ago, he abandoned 16-mm film to concentrate on 'home movies'. He is enthusiastic about the advantages of modest approaches to media production. The book is a comprehensive review of 8-mm hardware and of software production techniques.

Of the many existing manuals on film production, several devote a significant amount of their time to 8-mm film-making:

COYNIK, David. *Moviemaking.* Loyola University Press (Chicago IL 60657. $3.50), 1974.

Although this book is oriented to American students familiar with American feature films, it offers a number of interesting exercises for developing creative as well as technical skills. It is oriented toward 8-mm film.

EASTMAN KODAK Co. *Movies with a purpose: a communicator's guide to single concept films.* Eastman Kodak Co. (343 State St, Rochester NY 14650. $0.15), No. VI-13, 1974.

This booklet demonstrates some very basic concepts of film design. It discusses conceptualization of film messages, storyboarding, shooting, and fundamentals of lighting and editing. It is well worth the investment. Upon request, Kodak will send an index of their entire technical film publications.

GLENN, George D.; SCHOLZ, Charles B. *The super 8 handbook.* Howard K. Sams Co. (Indianapolis IN 46268. $4.50), 1973.

Since it has been in print for over three years, the hardware information in this book is almost completely outdated. However, there are good sections on how to budget, script, organize, shoot, and edit 8-mm films inexpensively.

LIPTON, Lenny. *Independent filmmaking.* Straight Arrow Press, (625 Third St, San Francisco CA 94107. $7.95), 1973.

Although it is primarily oriented toward 16 mm, this excellent introduction to film-making makes extensive comparisons between 16 mm and 8 mm. Of course, hardware information is out of date.

MERCER, John. *An introduction to cinematography*, Stipes Publishing Co. (10-12 Chester St, Champaign IL 61820. $5), 1974.

This book is full of practical exercises and techniques for becoming a good cameraman and film-maker.

Anyone undergoing training for film production should also acquaint himself with the better works in the film theory and visual communications literature. A few of those works are listed below:

ARNHEIM, Rudolf. *Film as art*. University of California Press, (2223 Fulton St, Berkeley CA 94720. $1.95), 1958.

One of the major theorists on art and visual perception makes his statement on film.

——. *Visual thinking*. University of California Press (2223 Fulton St, Berkeley CA 94720. $4.25), 1969.

In this work, Arnheim deals in depth with concepts which should be of interest to any film-maker.

EISENSTEIN, Sergei. *Film sense*. Harcourt, Brace, Jovanovich, (757 Third Ave, New York NY 10017. $2.45), 1958.

Eisenstein was not only a great director, but also a brilliant film theorist. His thoughts are as worthy of study today as they were when they were written.

GASKILL, Arthur L.; ENGLANDER, David A. *How to shoot a movie story : technique of pictorial continuity*. Morgan & Morgan Inc. (Hastings on Hudson, N.Y. $2.50).

This book specializes on motion-picture photography, and the particular visual conventions of film language. Reading this book will help 8-mm film-makers avoid 'reinventing the wheel' as regards visual storytelling.

MANTE, Harold. *Photo design*. Van Nostrand, Reinhold Company, Litton Educational Publishing Inc. (450 West 33rd St, New York NY 10001. $12.95), 1971.

——. *Color design in photography*. Van Nostrand, Reinhold Company, Litton Educational Publishing Inc. (450 West 33rd St, New York NY 10001. $15.95), 1972.

The above two books offer an excellent introduction to the subject of photographic composition. All films should treat their subject matter in a visually artistic manner. There is no reason why a practically oriented film cannot also have artistic quality. These books are helpful in sensitizing beginning film-makers to visual design.

MCKIM, Robert. *Experiences in visual thinking*. Wadsworth Publishing Co. (Belmont, CA 94002. $7.95), 1972.

This excellent workbook helps sensitize the student to the unrealized potential of the human brain to think in visual terms. Many fascinating exercises for developing this facility are scattered throughout the book. All film-makers should be visual thinkers. This book can help them become that.

There are a number of magazines which follow developments in 8 mm. Several of them are listed below:

Movie-maker. Model & Allied Publications, Ltd. (13-35 Bridge St, Hemel Hempsted, Hertsfordshire, England. Annual subscription price: $10).

This magazine is in the best tradition of the British hobbyist. It gives extremely thorough treatment to 8-mm equipment. Many technical tips are included on how to achieve professional effects at low cost. One of their columnists is credited with the invention of the word 'super 8'.

Super 8 filmaker. PMS Publishing Co. (3161 Fillmore St, San Francisco CA 94123. Subscription price: $7 per year for six issues).

This magazine includes articles on specific professional and semi-professional applications of 8-mm film. Articles on technical tips are included in each issue. The magazine generally covers more items than *Moviemaker*, although in less depth. Unlike *Moviemaker*, this magazine stays right up to date on the newest advances in 8-mm hardware.

Filmmaker's newsletter, Suni Mallow, ed. (80 Wooster St, New York NY 10012. Subscription price: $3 per annum). Monthly.

Although this magazine is oriented toward the independent 16-mm producer, each issue has a column entitled 'Super Serious 8', which gives an in-depth analysis of some new piece of hardware from the critical perspective of the 16-mm film-maker.

It is virtually impossible for anyone to be in direct communication with all the manufacturers of 8-mm related equipment. During the course of this study, a list of over 175 manufacturers was generated. Information regarding available products can be obtained from the above sources, and from the following catalogues, which contain fascinating information on products from many manufacturers in many countries:

Super 8 sound catalogue. Super-8 Sound, Inc. (95 Harvey St, Cambridge MA 02140. $2), 1975.

In addition to producing and distributing a broad range of 8-mm equipment, this firm has become the best clearing house of up-to-date technical information on 8-mm film in the United States. In addition to their catalogue, they publish a brochure detailing complete 8-mm systems for production and training. They also have available ($15) a loose-leaf notebook which, they maintain, includes manufacturers' information on every piece of 8-mm equipment produced anywhere in the world.

The superior bulk film catalogue. Superior Bulk Film Co. (442-450 N. Wells St, Chicago IL 60610. Free), 1975.

In addition to film, this catalogue lists lights, tripods, and accessories of all types.

The Edmund scientific catalogue. Edmund Scientific Co. (100 Edscorp Bldg., Barrington NJ 08007. Free).

This is a complete resource for anyone with a love for photographic and scientific gadgets. Inexpensive equipment for special effects and trick photography abound.

Finally, for broader perspectives on where the film medium has come from and on new avenues for further development, the following resources are worthy of consideration:

BOBKER, Lee R.; MARINIS, Louise. *Making movies: from script to screen.* Harcourt, Brace & Jovanovitch (757 Third Ave, New York NY 10019. $7.50), 1973.

The authors have a wealth of experience in professional filmmaking. Their knowledge is communicated in practical and vivid ways. Sample storyboards, scripts, budgets, and stills from major feature films offer the 8-mm experimenter points of references which may be useful in devising new communication techniques.

DIAMANT, Lincoln. *The anatomy of a television commercial.* Communication Arts Books (Hastings House Publishers, Inc., 10 East 40th St, New York NY 10016. $12.50), 1970.

This book offers an excellent in-depth account of a communications format which has been developed to a high degree of sophistication in the United States. Some of its lessons may offer insights relevant to the work of 8-mm film-makers.

FUGELSANG, Andreas. *Applied communication in developing countries* and *The story of a seminar in applied communication*, Dag Hammarskjold Foundation (Ovre Slottsgatan 2, 752 20 Uppsala (Sweden). $11), 1973.

These short books provide an excellent introduction to the problems of using visual media to communicate with people from non-Western cultures. Their orientation is one of reverence for cultural diversity and practical suggestions for methods of communicating cross-culturally.

GUNTER, Jonathan F. *NFE-TV: television and nonformal education.* University of Massachusetts (Nonformal Education Center, 285 Hills House South 285, University of Massachusetts, Amherst MA 01002. $4).

This study reviews the philosophies of Freire, Illich and Coombs for their implications regarding media usage in non-formal education. Three case histories of educational television are presented and used to define a realistic role for television in non-formal education in non-industrial countries.

KENNEDY, Tim. The skyriver project: the story of a process. *Access-challenge for change.* National Film Board (P.O. Box 6100, Montreal, Quebec H3C 3H5 (Canada). Free.). 1973.

This article recounts the history of a project which applied film to community development problems in Alaska. A fascinating method

was devised whereby control over shooting and editing passed from the professional film-maker to democratic community consensus. Filming centred upon specific problems facing the community. Results included showing finished films to government decision-makers and thus obtaining decisions favourable to the community in health and education matters. 'Skyriver' contains lessons relevant to the 8-mm film-maker who aims at effecting real world change through his work.

NORDENSTRENG Kaarle; VARIS, Tapio. *Television traffic: a one-way street?* (Reports and Papers on Mass Communication no. 70.) (Unesco, 7 Place de Fontenoy 75000 Paris (France) 6 F.)

This study documents the global flows of television programming from a small number of industrialized countries and to the rest of the world. Questions are raised regarding the effects of this pattern upon the world's diverse cultures. Much information is contained concerning the communication environments in which 8 mm will develop.

O'BRIEN, Rita Cruise. *Domination and dependence in mass communications: implications for the use of broadcasting in developing countries.* (DIDS Discussion Paper No. 64.) (Institute for Development Studies, University of Sussex, Brighton (England)).

This thought-provoking paper focuses upon questions of institutional and cultural dependence which hinder non-industrial countries in their efforts to apply broadcasting to development objectives.

REED, Fred W. *Pretesting communications: a manual of procedures.* University of Chicago. (Communication Laboratory, Community and Family Study Center, University of Chicago, 1126 E. 59th St, Chicago IL 60637. $1.)

This volume presents strategies and methods for incorporating formative testing into the production and editing process. Although it focuses on a number of 'modest media' besides film, and although its subject orientation is family life education, the book contains ideas which should be of great value to the 8-mm experimenter who wants to base editorial decisions on scientific research as well as creative intuition. All the concepts and techniques listed can be understood and implemented by non-specialists and without devoting massive resources to testing.

VARMI, Ravi; GHOSAL, S. L.; BOWERS, John; HULLS, R. H. *Action research and the production of communication media.* University of Reading. (Agricultural Extension and Rural Development Centre, University of Reading, 16 London Road, Reading, RG1 5AQ (England) $2.50.)

This short book relates the experience of a field workshop in India, wherein practical evaluation methods were incorporated into the media production process. Along with the above volume, this book offers convincing evidence of the need for doing this and practical guidelines on how to do it. This book should be read by all experimenters in 8-mm film communication.

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